The Dock and Harbour Authority

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Editorial Comments

A Modern Texan Port.

The illustrated article on the Port of Corpus Christi in this month's issue describes the recent creation and rise to a position of considerable commercial standing of a port on the Gulf of Mexico, which, perhaps, is somewhat better known on the other side of the Atlantic than in this country. Cotton and oil are the staple export commodities on which its prosperity is founded, though, in addition, it serves as an outlet for the agricultural produce of a region which is distinctly agrarian. The State of Texas is remarkable in a number of ways—partly on account of its immense size, partly by reason of the fertility of its soil, and latterly, not less for its rich resources in mineral oil. Among the leading ports on its coastline of 400 miles, Corpus Christi ranks, with one or two others, after Houston and Galveston, having risen steadily in importance since the date of its constitution as a port nearly twenty years ago.

At one time Texas formed part of the Republic of Mexico, but a little more than a century ago, the War of Texan Independence broke out and was terminated in 1836 by the defeat of the Mexican forces. Thereafter until 1845, Texas was an independent republic, subsequently becoming incorporated in the American Union, despite the protest of Mexico.

The region is subject to occasional catastrophic visitations. In 1899 and 1902, there were destructive floods on the Brazos River, while in 1900, a great tropical hurricane swept along the coast, wreaking tremendous havoc, especially at the Port of Galveston, where a sea wall was subsequently built as a protection against tidal inundations of the magnitude experienced at the time. It is related that the wind, which reached a velocity of 96 miles per hour, piled the waters of the Gulf of Mexico upon the city to such an extent that every building on the sea front and for three blocks behind was completely destroyed. The loss of life was estimated at 3,000 and the damage to property at 20 to 30 million dollars. Happily, such occurrences are extremely rare, and the protective measures now available should suffice to minimise their destructive effects. It is to be hoped that the Port of Corpus Christi will escape similar calamities and pursue an unbroken career of prosperity and success.

New Port Authority Chairmen.

The past month has been notable in respect of the changes which have taken place in the administrative leadership of the two chief ports in Great Britain. London and Liverpool have alike suffered, in the one case by resignation and in the other by death, the loss of eminent chairmen who have most capably administered the affairs of these ports for a number of years past. Particulars of the distinguished careers of both gentlemen having appeared in quite recent issues of this Journal, in the series of Notable Port Personalities (No. iv., Lord Ritchie, November, 1940, and No. vii Sir Richard Durning Holt, February, 1941), it is unnecessary to relate again the record of their public services, which are too well known and appreciated in port circles to require repetition.

Fitting tributes have been paid to them by the bodies with which they were connected. The members of the Port of London Authority have placed on record their high appreciation of the conspicuous services of Lord Ritchie, who has " by his able leadership and unfailing courtesy, combined with his business ability and intimate knowledge of the undertaking conducted the affairs of the Authority with outstanding success." The work of Sir Richard Holt has received similar acknowledgment from the Mersey Dock Board, with an expression of deep and sincere regret at his decease.

The thoughts of our readers will naturally turn to their successors in the onerous and responsible duties which they have undertaken, and it can be said without hesitation that, under the experienced direction of the Right Hon. Thomas Wiles and of Sir Thomas Brocklebank, respectively, the commercial interests of the ports of London and Liverpool will be carefully safeguarded and the development of their seaborne trade sedulously fostered.

Mr. Wiles has been a member of the Port of London Authority since 1923, and has served on two of its most important committees. He was elected as a representative of the " Goods " section in the port, having been closely associated with the grain trade. Having travelled extensively abroad, his personal knowledge of the leading ports in Europe, South Africa and the Orient will serve him well in dealing with the world-wide ramifications of British commerce overseas.

Sir Thomas Brocklebank is equally well-known in Liverpool shipping circles, by reason of his being a director of Messrs. Thomas and John Brocklebank, the Cunard-White Star Company and other prominent concerns. He has been a member of the Mersey Docks and Harbour Board for a number of years and latterly has been deputy-chairman.

The good wishes of our readers will be extended to both the new port chairmen on their assumption of office.

Ships' Cargo Handling Gear.

As port officials, and especially dock superintendents, are only too well aware, a ship's own mechanical equipment often plays a predominant part in cargo handling operations at the quayside, much to the regret of the port authorities concerned, who frequently find it displacing the elaborate and costly installations of quay cranes which have been provided for the same purpose, and without which a port could scarcely claim to be complete. Naturally, if a ship is equipped with suitable hosting gear (as must generally be the case, since it falls to the lot of shipping to visit many varieties of port, some of which, not of the first rank, may be inadequately provided with quay cranes) there is every inducement for the owners to make use of their own plant, wherever possible, and it is not an uncommon sight at well-equipped ports to see a row of quay cranes standing idle while ships' winches and derricks are working at full speed.

Moreover, there are occasions, whether in port or in open roadstead, when, for over-side deliveries, ships' cranes and gear become essential, while in American ports, where burtoning or the double purchase gear system is practised, quay cranes are not generally available for use.

These are a few, among other reasons, why Mr. L. T. Morton's Paper on Ships' Cargo Handling Gear, reproduced in this issue, will undoubtedly be of interest to those of our readers whose duty it is to supervise cargo handling operations at ports. Although written from the shipowner's point of view, there is much valuable information in the Paper applicable to winches and derricks ashore, making due allowance for the difference in the conditions under which they are worked.

We would call particular attention to the statement in the Paper that while " tremendous thought and energy have been put into the problem of transporting cargoes from one port to another in a given time at a minimum cost, it is doubtful whether the same thought and energy have been devoted to the economy of loading and discharging the cargoes." The implications of such a statement are most important to shipowners. We would go further and add " rapidity " to " economy." In war time so important a consideration becomes paramount; every hour saved in the turn-round of a ship in port is of the utmost value in the national effort to defeat the enemy.

Editorial Comments—*continued*

National Expenditure and Port Operation.

The Tenth Report of the Select Committee on National Expenditure, which was published at the beginning of the month, is, as will be seen from the partial transcript in this issue, concerned almost entirely with certain aspects of port working and the possibilities of effecting increased economies, not only in expenditure, but equally, if not more importantly, in time and effort.

At the outset, the keynote is struck in the section on the Handling of Shipping in Home Ports, where the Committee, endorsing the representations of their Sub-committee on Transport Services, emphasize the fact that in the discharge and loading of cargoes and especially in the clearance of goods from the ports, lies the chief cause of persistent congestion. The responsibility for the present state of affairs is placed upon the Ministry of Transport, but with an extenuating reference to the " manifold problems " with which the Ministry has to deal.

The Committee declare themselves as satisfied, from the evidence which they have received, that there have been, and still are, delays in cargo handling operations, which could be shortened, thus confirming views which have found repeated expression in these columns. Some of the defects and weaknesses of the existing system of working have, in fact, been pointed out, but the Report draws attention to one which we have not hitherto mentioned, viz., that there is a practice prevalent in some ports whereby delay is caused through dock workers being allowed to pick and choose the cargoes which they are prepared to handle. In peace time, this practice cannot but be a source of inconvenience, but, as a matter of common sense, during war conditions, it must cease definitely and at once. The dock labourer with his antipathy to registration and regular employment and his tendency to intermittent, and even frequent, absenteeism, has had rather too much consideration paid to his likes and dislikes; in this time of national emergency, he must learn to come into line with his less pampered fellow citizens. It is the stern duty of every one to use his best endeavour to carry out whatever duty the State may lay upon him.

Another matter in connection with port operation, to which the Report alludes, is the insufficiency at certain ports of mechanical cargo-lifting appliances, due partly to lack of foresight and partly to the diversion of shipping from their customary home ports to others outside the limits of their normal routine. This deficiency in plant will, no doubt, be remedied as quickly as possible, but it may be pointed out that there are few ships nowadays which are not adequately equipped with mast derricks and deck cranes for cargo handling. Indeed, in many cases, as stated in the preceding comment, these are, and have been, used to the exclusion of the quay cranes provided for the same purpose by the port authority. It is distinctly opportune that there appears in this issue an article on the subject of ships' cargo handling gear, to direct attention to the developments which have taken place in this sphere. Indeed, we suggest that it is not so much the shortage of " powerful cranes and elevators " which is the cause of congestion, as the deficiency in means for getting goods away expeditiously from the quayside to make room for succeeding freights. The Report quotes the saying that " the ship will always beat the shore," a truism which, under present circumstances, is only too evident. We believe that, generally speaking, there are ample facilities for handling cargo between ship and quay: it is between quay and consignee or between transit shed and warehouse that the trouble chiefly occurs.

Departmental Responsibilities.

The Report indicates the diffusion of responsibility for efficient port operation between the Ministry of Transport and the Ministry of Shipping, to which must be added the Ministry of Labour. This partition of supervision is, indeed, a root cause of many of the difficulties of the situation. There are so many bodies involved and so many interests to be considered: port authorities, railway officials, road hauliers, labour unions, employees' associations, traders and shipping firms—to say nothing of the three departmental ministries previously mentioned. It seems impossible, despite the appointment of Port Emergency Committees, Port Controllers and Regional Representatives, to get a working arrangement free from circumlocution and delay.

Another feature is the tendency of departmental authorities to disclaim any sort of association with one another. Recently, the Minister of Transport replying in the House of Commons to a question on the holding-up of the turn-round of ships at Glasgow, said " A lot of things besides unloading and loading comes into the holding-up of ships. I am responsible only for that side of the picture " and the luckless questioner was referred to some other unspecified quarter for the information he desired. In slang terms this is described as " passing the buck."

The tendency to evade the initiative of embarking on independent investigation is characteristic of the official mind and constitutes a serious difficulty. It inevitably implies a reluctance to handle problems which are unfamiliar and of technical complexity. The Report itself raises the question whether " the appointment of some men as Regional Port Directors, *without previous experience* of all the ramifications of shipping and port management, is likely to bring success in discharging adequately and efficiently the very onerous responsibilities involved in securing the rapid clearance of both ports and ships." The italics are ours, for we fear the doubt is fully justified; some surprise has certainly been caused by one, at least, of the appointments recently made.

The War Transport Council.

Whether the creation of a War Transport Council, as announced by the Minister of Transport, will do anything to clear the situation by means of centralised control remains to be seen. The composition of the Council, which includes one port manager, is necessarily extremely heterogeneous and while each member of the conclave of experts may be eminently qualified to deal with questions within his own particular sphere, there is no guarantee that the whole body will be in a position to adjudicate competently and impartially on any matter which may be outside their individual experience. They may, and almost inevitably must, follow the lead of their colleague who is expert in the matter; and in that case, it may be asked wherein lies the advantage of a " multitude of counsellors." On the other hand, the advantage of a centralised authority to settle questions of policy affecting numerous and varied interests cannot be gainsaid. It is in this respect that the Council may be really useful. The principal defect of the step is that it is so belated.

Sand Travel and Madras Harbour.

As described in a communication in the Correspondence Column of this issue from the Port Engineer of the Madras Port Trust, an interesting experiment is being made at Madras Harbour for the economical control of the sand accumulation, which for some time past, has been menacing the efficiency and even the accessibility, of the harbour entrance. The experiment will be watched with no little attention by all engineers who have to contend with the difficulties of harbour maintenance in sandy localities.

It will be noted as an essential feature of the problem that the accretion in the vicinity of the Southern and Easterly breakwaters is accompanied by corresponding erosion of the shore line to the leeward, and this gives confirmation, if any be needed, to the theory of a rotary movement of the current beyond the obstruction which induces the accretion. Were it not that the Port Trust had taken steps to revet with stonework the shore frontage immediately North of the harbour, this erosive action would, in all probability, have manifested itself almost to within close proximity of the Northern breakwater. It is interesting to observe the recession of the shore line between 1876, when the breakwaters were constructed and the present time.

Proposed Dry Dock for South African Port.

For some time past there has been a steady and persistent demand in the South African press and shipping circles for the provision of a large, up-to-date dry dock at Capetown. An item for such a work was, in fact, included in the harbour development scheme now making rapid progress towards completion, and steps were taken to make a survey of the proposed site. But the heavy cost of the proposal has proved a definite deterrent under present conditions, and the Dominion Government are reluctant to embark on any more expenditure than that involved in carrying through the project for the enlargement of the harbour basin accommodation.

Protagonists for the dry dock have proclaimed that an important ship repair contract was lost to the port recently through inability to provide the requisite means and facilities for the execution of the repairs. Agitation, therefore, has been continued in the hope of inducing the Government to reconsider its adverse decision, but present advices from South Africa indicate that there is little prospect of a change in policy. Indeed, the latest press information to hand is to the effect that the Minister of Railways and Harbours in a recent discussion with the Harbour Advisory Board, emphasised that, while he personally was satisfied that the existing dry dock facilities were inadequate for present-day requirements, it was quite impossible for him to make any promise as to the early construction of a dry dock.

He pointed out that there are at the moment and will be for some years to come, far more urgent works to be undertaken with the capital funds at the disposal of the Administration, and that it will not be practicable to provide funds for the construction of a graving dock until these other works have been dealt with.

Simultaneously has come the news that the Port Elizabeth (Algoa Bay) authorities are questioning the desirability of locating a new dry dock at Capetown and urging that the selection of a site should be referred to a technical commission for investigation.

The widening aspect of the matter (for it affects all the ports in the Union) renders it impracticable to express an opinion without a fuller knowledge of the local conditions, but as regards the general question of the provision of a large, up-to-date dry dock in South Africa, there will be a general consensus of opinion that such a facility is greatly to be desired. The present accommodation at Capetown is limited to a dock, which is only 500-ft. long, with 68-ft. entrance width and a depth over sill of 26-ft. Obviously, this is much below the standard of modern requirements.

The Port of Corpus Christi, Texas, U.S.A.

Creation of a Modern Cotton and Oil Port

By L. M. ADAMS, Port Director.

Foundation of the Port

THE PORT OF CORPUS CHRISTI came into existence in September, 1922, when the Rivers and Harbours Act authorised the expenditure of $750,000 (for the first year's work) to build a " safe and adequate harbour " on the lower Gulf Coast of Texas. Prior to this action, of course, the federal engineers made the usual exhaustive surveys of all points in this area, Corpus Christi having been victor in a spirited competition.

Dredging operations were begun in 1924, completed in July, 1926, and the Port was opened on September 14th of the same year. The construction of the present breakwater, the north wing of which gives protection to the Port's main basin, was carried on simultaneously with the dredging operations, funds for the work having been provided by a State Aid Act. Engineering design, together with the safety measures provided by the breakwater, has given Corpus Christi " a safe harbour " in every sense of the word. Its adequacy is attested by the record it has established. The port can accommodate vessels with draughts up to 30-ft.

Quayside Views at Port of Corpus Christi:—
(Top) Discharging Oil-well Casing and Canned Goods and (bottom) Loading Cotton for Export.

Entrance Channel

The Port is connected with the Gulf of Mexico by a 21-mile channel, deepened progressively from 25 to 32-ft. Ships bound for Corpus Christi leave the Gulf of Mexico at Aransas Pass, the opening being 500-ft. wide and 36-ft. deep. The channel, extending across the quiet waters of Corpus Christi Bay, is free from sharp bends, and is navigable by day or night. At its inner extremity is a turning basin 3,000-ft. by 1,000-ft.

Port Accommodation

At present, the Port of Corpus Christi has 10 fine wharf sheds, and 7 oil docks, two of which are privately owned and operated When the accommodation was opened in 1926, only four warehouses, offering 193,929 square feet of space were available. Warehouse space at present totals 506,354 square feet. All of it is automatically fire-sprinklered. The Port's fire record is exceptionally good.

The district's original property was confined to 315 acres, all immediately adjacent to the main turning basin. Forseeing the expansion of the waterway facility to the West, the State of Texas, at the District's request, assigned to it 2,700 acres of property, designated as submerged land. The land extends westward to include the mouth of the Nueces River. Much of it has been adapted to navigation development. An industrial canal a mile-and-a-half long, 150-ft. wide and 30-ft. deep has been cut through this property to a new inner basin at the silo of the basic alkali plant of the Southern Alkali Corporation at Avery Point.

Maintenance of Channel

The Federal Government has, by act of Congress, taken over the maintenance at project depth of the ship channel leading to the Gulf, both turning basins, and the industrial canal. No difficulties have ever been experienced in maintaining water depths. Although the Nueces River empties into Nueces Bay, levees, created by dredging spoil, eliminate silting trouble in the basins and industrial canal. Corpus Christi Bay, as previously mentioned, is comparatively quiet. It has a low normal tide, as Gulf waters are shut out by low-lying islands, the only open water being in the passes. As a consequence, maintenance of the 21-mile channel at full project depth has been possible at a minimum expense to the Government.

With the development of South Texas oil and gas resources continuing at a rapid rate; with the city's position as a distributing centre being consolidated; with indications pointing to normal cotton crops; with the Corpus Christi territory recognised as the fastest growing in the State, Navigation District officials feel sanguine as to the future.

Trade of the Port

The chief commodities handled are Imports; iron and steel, cement, asbestos, shingles, bagging and tiles; Exports: cotton and cotton seed products, fish products, scrap iron, citrus fruits (canned and fresh), lead, sulphur, crude oil, gasoline and rice.

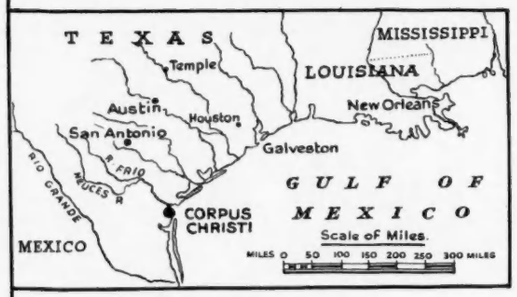
During the past five or six years the Port has rapidly changed from one designed to deal with cotton as its principal tonnage to a major oil port. This is evident from the following brief statistics covering seven complete calendar years:—

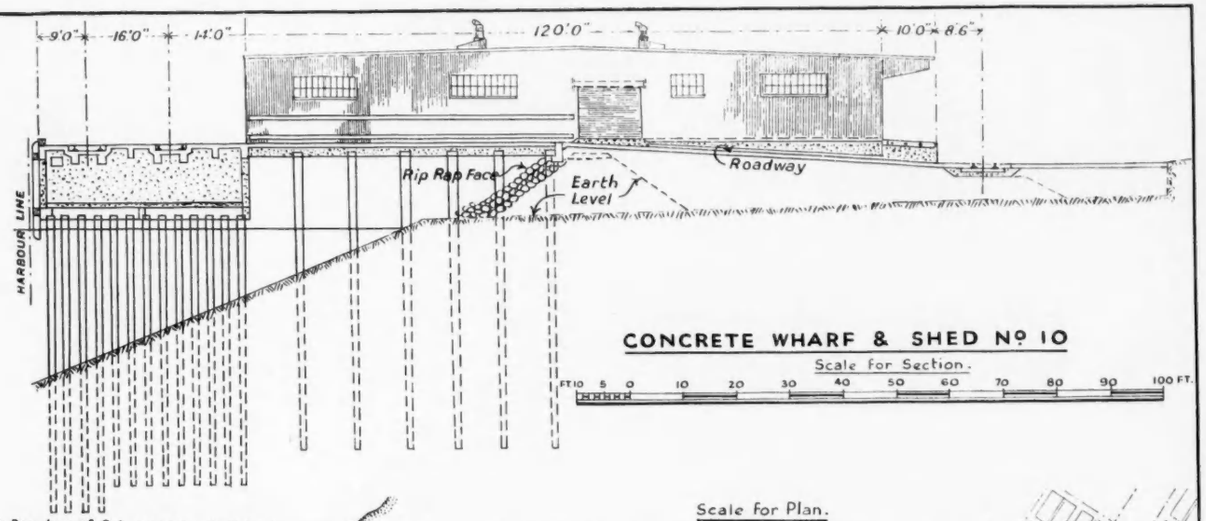
Barrels of Crude and Refined Products Shipped.

	Coastwise		Exported	
Year	Crude	Refined	Crude	Refined
1933 ...	1,292,142	633,806	352,258	28,902
1934 ...	2,025,474	606,649		8,176
1935 ...	3,119,808	939,550	1,182,298	61,823
1936 ...	17,239,647	1,059,736	2,856,014	125,875
1937 ...	18,960,467	3,150,960	6,435,958	2,657,331
1938 ...	16,574,576	6,072,244	10,671,062	6,602,460
1939 ...	15,653,821	9,338,574	12,456,026	9,035,227

There are over 8,000,000 barrels of oil-tank storage at the Port of Corpus Christi, all connected to one or more of the seven oil docks available. Twenty-eight gathering pipe lines bring the oil to this tankage from 135 oil fields all within 125 miles of the Port.

PORT OF CORPUS CHRISTI.
— TEXAS —




9'0" 16'0" 14'0" 120'0" 10'0" 8'6"
HARBOUR LINE
Rip Rap Face
Earth Level
Roadway
CONCRETE WHARF & SHED Nº 10
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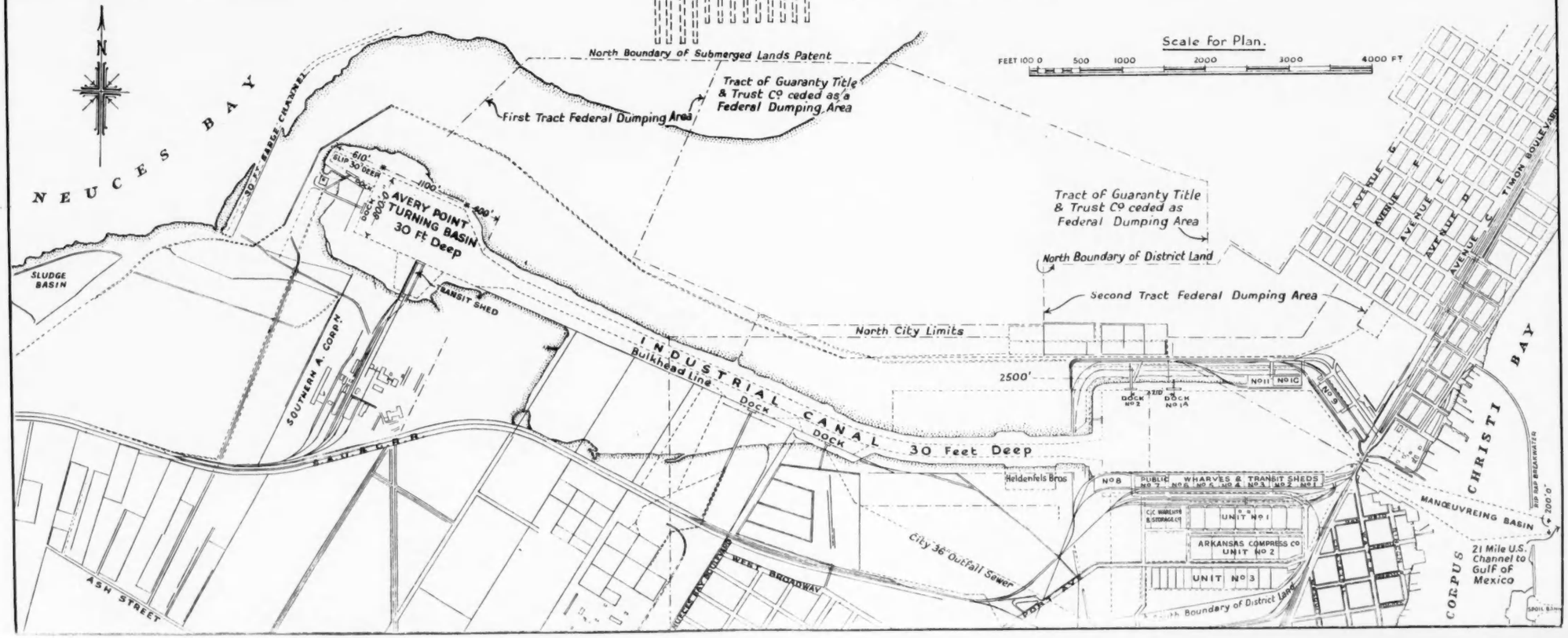


The Port of Corpus Christi—continued

Aerial View of Port of Corpus Christi.
In foreground—Basic Alkali Plant of the Southern Alkali Corporation. Next—Pontiac Refining Corporation. Next—Barnsdall Refining Corporation. Next—Generage American Tank Storage Terminals. In Distance (top left)—Main Turning Basin.

Aerial View of Main Turning Basin—Port of Corpus Christi.
Right foreground—Public Oil Dock No. 1. Left foreground—Public Oil Docks 1a and 2.
Right middleground—Aransas Compress Company Units Nos. 1, 2 and 3.

The Port of Corpus Christi—continued

The Navigation District maintains five public oil docks and in addition the Barnsdall Refining Corporation and the General American Tank Storage Terminals each owns and operates a private oil dock. Two more private oil docks are being built to deal with the expanding oil movement.

The Texan Hinterland

An essential feature of a prosperous port is a spacious and productive hinterland and in this respect the Port of Corpus Christi is not lacking. The State of Texas (familiarly known across the Atlantic as the " Lone Star State ") on the coastline of which the port is located is by far the largest of the federated territories in the North American Union. It has an area of 265,896 square miles, or considerably more than double the area of the British Isles. So vast a superfices, affords corresponding scope for commercial and industrial development, especially as it lies in a luxuriantly productive sector of the globe, mainly between 25 and 35 degrees north latitude. The climate is sub-tropical. In the region of Galveston, some 200 miles to the north west of Corpus Christi, where the prevailing winds are South and South West from the Gulf of Mexico, the atmosphere is warm, moist and equable, but the moisture decreases somewhat towards the West and South-West. Texas is one of the most important agricultural States in the Union. In 1935, there were over half-a-million farms covering 138 million acres.

Cotton and Oil

The principal exportable product, until quite recently, was cotton. Since 1880, Texas had been the largest cotton-producing country in the world. In 1939, the crop amounted to 2,830,000 bales. But since about 1935, the oil industry has been acquiring a predominant position. The State leads in the production of petroleum of which the output in 1938 was 470,760,325 barrels, equivalent to 40 per cent. of the total domestic output of the United States. The impetus to the industry in Texas sprang from the discovery in 1901 of the Spindle Top oil field near Beaumont. The fields now fairly numerous, are widely scattered with different characters. The output of carbon black from natural gas is also remarkable amounting in 1938 to 417 million pounds, which is no less than 85 per cent. of the United States total. Of natural gas itself, the output is of the order of a million million cubic feet and of natural gasoline about 650 million gallons.

The more notable ports are Houston, Galveston and Corpus Christi. Both Houston and Corpus Christi are approached by artificial ship channels from the Gulf of Mexico.

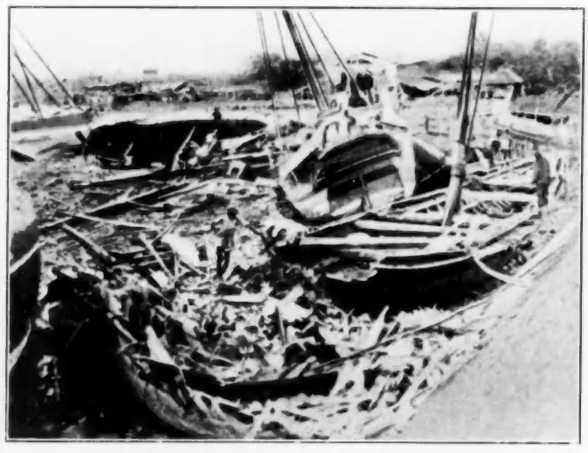
The Great Cyclone at Bombay

Some of the Victims in the Harbour.

In the March issue of this Journal, there was published a statement by the chairman of the Bombay Harbour Commissioners on a terrific storm which visited the port on October 16th last year. The following additional particulars have since been published in the *Port of Bombay* magazine:—

So great was the intensity of the wind that at its peak it reached a maximum velocity of over 70 miles per hour, creating conditions in the harbour which made rescue work more or less impossible. The Bombay Harbour with its 70 square miles of area can be considered comparatively secure; in this case, the direction of the storm was most unusual as it came straight across the harbour towards the docks and bunders, that even the smaller craft considered safely moored alongside were severely damaged, and in many cases totally wrecked.

The country craft suffered the most damage, as at that time of the year, hundreds of craft lie at the country craft anchorage off the Prince's Dock Harbour Wall. Here can be found Baghlas from the Persian Gulf and Arabian Coast, Kotias and Dhangis from Cutch and Sind, and Pattimars from the Konkan, the larger craft often of nearly 400 tons burden, some loaded with general cargo and ready for sea, others with cargoes of coir and cocoanut



Country Craft Wreckage at one of the Bunders.

waiting to unload at the bunders, others with empty holds waiting to load. In addition were all the harbour craft at their various anchorages.

Chaos prevailed as boat after boat began to drag her moorings towards the shore, until the whole anchorage was out of control, many were overturned and wrecked in a very short time, and the crews left to the mercy of the waves. Others, that had drifted towards the bunders, piled up against the craft already moored there, and with the constant pounding against the sea wall, were heavily damaged or wrecked.

Against such a contingency no adequate provision could be made. Full use was made of the life-saving equipment provided at the bunders, but little assistance could be rendered in the early stages of the storm to the crews of the boats which came to grief at some distance from the shore, where they were not within the reach of the lines.

Nothing but the more powerful mechanically-propelled craft could survive and the Port Trust smaller craft also suffered damage in consequence. The larger Port Trust craft rendered assistance whenever possible, but owing to their deeper draft, were of no value around the bunders.

As the end of the storm approached, the wind fell, and the rain clouds broke and disappeared and the sea lost its violence. A reckoning could now be made. Many valuable lives were lost of men whose calling was the sea, but alas had exacted her toll. Wreckage everywhere with heavy loss to merchant, shipowner and fishermen alike.

So can be recorded one of the worst storms to strike Bombay, and in the future with this grim experience behind us more ade-

Damage at Lakri Bunder.

quate provision will be made to safeguard the lives of Indian seamen, and perhaps the day will dawn when India will possess her own Life-Boat Institution so that there shall be no repetition of this calamity.

Errata.—The writer of the article on Sliding Caissons for Dock Entrances which appeared in the April issue, calls attention to two typographical corrections which are necessary, viz.: near the foot of the second column of page 131 for

$$T = \sqrt{\frac{L^2 H}{44{\cdot}800}} \text{ read } T = \sqrt{\frac{L^2 H}{44800}} \text{ and for}$$

$$T = 0074 \sqrt{H} \text{ read } T = 0{\cdot}074 \sqrt{H}$$

Correspondence

To the Editor of "The Dock and Harbour Authority"

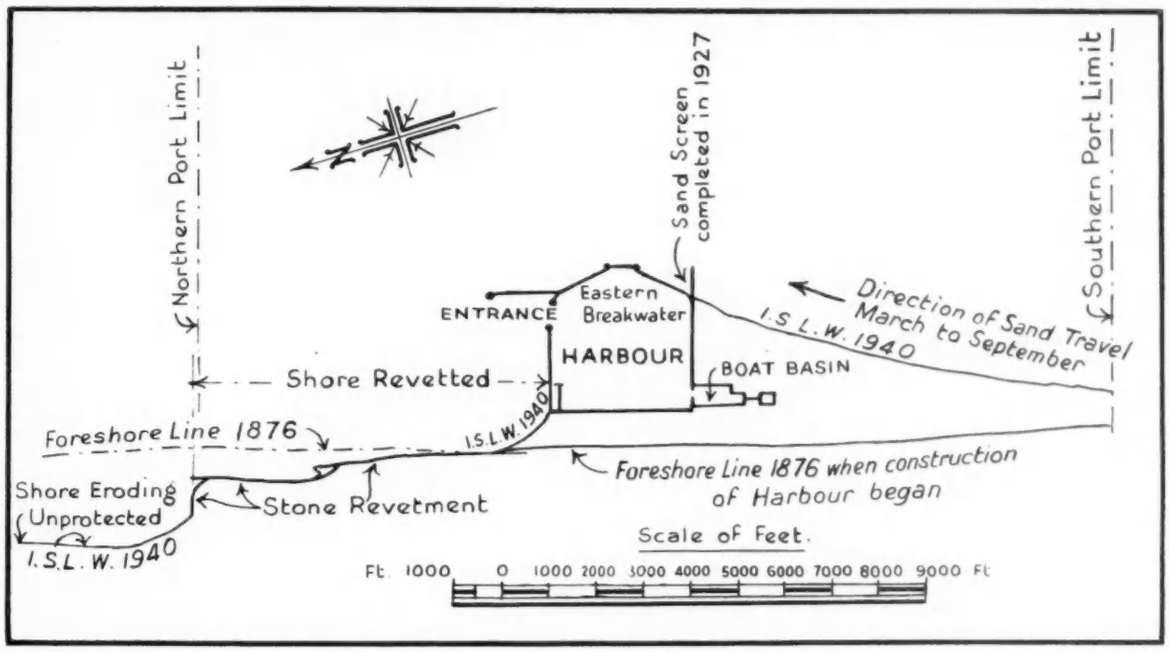
Sand Travel at the Harbour of Madras

Dear Sir,

The Editorial comment in the October, 1940 issue of *The Dock and Harbour Authority* on the subject of "Sand Travel on the Coromandel Coast," includes a very brief but accurate description of the measures which have been taken to retard the movement of sand towards the approaches and entrance to Madras Harbour.

The second paragraph of your note refers to a proposal to revert to the former policy of "systematic dredging," presumably as opposed to extending the southern breakwater, and it is in this connection I am offering some more up-to-date information which may be of interest to harbour engineers and students of this subject.

Briefly, it is proposed to mount a single sand pump on a carriage which will move up and down the Sand Screen and dredge a "cut" parallel to the groyne some hundreds feet north or south of the centre line; the sand for the present will be discharged through a 10-in. line into one or other of the Board's dredgers lying inside the sheltered harbour from where it will be discharged at sea. The rate of flow of new sand into the "cut" and the movement of the contours between the groyne and the harbour entrance will be observed; it is hoped to obtain sufficient data from this small experiment to determine how far the movement of sand can be controlled by operating a battery of pumps from shore. If the effect is appreciable and the cost reasonable, the Board has in mind a development of this scheme which involves pumping as much of the annual accretion as possible through a pipe line to a point 1¾ miles north of the harbour where land is eroding at the rate of 20-ft. to 30-ft. per annum; the point referred to is outside Port limits, and it will be necessary to enlist the financial interest of the Madras Corporation in this work as



Madras Harbour and adjacent Shore Line.

In 1927, the extension of the southern arm of the harbour was completed at a cost of approximately £65,000, and the immediate result was an improvement in the water along the eastern breakwater; this improvement was maintained for several years. By 1935, however, a marked deterioration had set in, which has become progressively worse recently. Large quantities of sand find their way round the end of the extension, and the 20-ft. and 30-ft. contours are slowly but steadily creeping nearer the harbour entrance. The extension of the southern arm, or the Sand Screen as it is known, is gradually becoming enveloped in sand, and there is now only 8-ft. of water at the tip of the groyne as compared with 20-ft. in 1927 when work was completed.

The prediction that Sir Francis Spring made in 1912, *vide* his Paper to the Institution of Civil Engineers, London (Minutes of Proceedings, Inst.C.E., vol. cxciv), that the Board would be faced with a serious sand problem by 1952, is borne out by the observations made during recent years, for the small extension of the southern breakwater has interfered very little with the travel of sand.

The Board could, as you suggest, go on "extending the spur into still deeper water and gain a respite in time," but other methods have to be investigated before it commits itself to a scheme which involves extending the present Sand Screen indefinitely and which, at the best, is only a palliative. It is also possible that an appreciable extension seawards of the groyne might aggravate erosion along the coast North of Madras, and the Board is naturally anxious to avoid extending what is already a difficult and contentious problem.

For this reason, the possibility of dredging the annual accretion was examined, but the expense of purchasing and maintaining a large dredger, capable of working in a heavy seaway during the South-West monsoon, would impose a severe strain on the Board's Revenue Account, and for this reason it was decided to carry out certain experimental work which the Government of India recently sanctioned, and which you refer to in the second paragraph of your note.

Although the experimental work falls under the heading of "dredging," it is not a "reversion to the former policy of systematic dredging" mentioned in your note.

it is their land which is mostly affected by erosion, the Board having protected all its property by a rubble revetment. Bearing in mind that the accretion near the harbour and the erosion north of the harbour are complementary to one another, this appears to be a rational way of dealing with both problems, but it all hinges on whether or not sufficient sand can be removed by operating pumps from the shore: the experimental work, it is hoped, will answer this question.

Yours faithfully,

Madras. G. P. ALEXANDER,

23rd January, 1941. Port Engineer.

Floating Dock for the Port of Galveston

A contract for the construction of a floating dry dock, to be stationed at Galveston, Texas, has been placed with the Todd Shipyards Corporation by the U.S. Navy Department. The dry dock, which will cost $2,254,342, will have a lifting power of 18,000 tons, and will be capable of accommodating destroyers, cruisers and practically all sizes of cargo vessels. Completion is expected in nine months.

The new dock will be constructed in three sections—a centre section and two end sections—in such a way that it will be self-docking. The end sections will be capable of dry-docking the centre section, and the centre section will be capable of dry-docking the end sections. The length of the dock overall will be 614-ft., between outriggers 544-ft. and the length of the centre section 384-ft. The width overall will be 116-ft., and between the wings 90-ft. The dock will weigh 4,800 tons.

The design provides for a circular bottom to ensure greater economy and strength. The effect is stated to be that when a ship is in the dock and the water has been pumped out of the buoyancy chambers, a greater buoyancy is created and the load is concentrated in the centre of the dry dock. It is expected that this type of dock will be able to lift some 30 per cent. more in relation to its weight than has been possible with older types. The new dock will be of all-welded construction.

Notes of the Month

New Mersey Dock Board Chairman.

Following the death of Sir Richard Durning Holt, Sir Thomas A. L. Brocklebank has been elected to the vacant chairmanship of the Mersey Docks and Harbour Board for the remainder of the current year. Mr. Edmund Gardner was simultaneously appointed deputy-chairman in succession to Sir T. Brocklebank.

Presentation Ceremony at Southampton Docks.

Mr. J. W. Grant, who recently retired from the position of assistant traffic controller at the Southampton Docks after 45 years' service with the Southern Railway has been the recipient of gifts from members of the staff at a special gathering at the South-Western Hotel, Southampton.

Ministry of Transport Port Appointment.

Mr. R. P. Biddle, whose services have been loaned by the Southern Railway to the Ministry of Transport, has now been appointed a Deputy Director of Ports. Mr. Biddle is the Docks and Marine Manager of the Southern Railway and was a member of the Lord Patrick Commission which enquired into the working of a Northern Port.

Retirement of Southampton Harbour Officials.

The retirement from official life is announced of three veteran members of the staff of the Southampton Harbour Board. These are Mr. E. C. Waller, cashier, who has been 47 years in the service of the Board; Mr. G. C. Lambert, a member of the clerical staff for 41 years and Mr. A. E. Crook, wharfinger with 39 years service.

Argentine Grain Exports.

According to a statement published in *Comisión Nacional de Granos y Elevadores*, it is officially estimated that the production of maize in the 1939-40 season exceeded 10.3 million tons. This figure was above the normal and, up to the end of December, only 12½ per cent. of the crop had been disposed of abroad. The case of wheat was quite different, the year's shipments having amounted to 3,620,000 tons as against an average of 3,417,959 for the previous ten years.

The Port of Quequen.

Allegations are made in the Argentine press that the Port of Quequen in Argentina is lacking in adequate port facilities. There is stated to be an undue accumulation of grain in the warehouses for want of efficient handling. To bring the port up to date, the Journal *La Prensa* advocates the expenditure of a sum of 23 million pesos on improvement works, chiefly in the extension of the Western breakwater and in dredging operations. The provision of addition shed accommodation for agricultural produce is also of prime importance.

Belfast Harbour Finances.

At the annual meeting of the Belfast Harbour Commissioners, the Right Hon. J. Milne Burbour, Ulster Minister of Finance, in moving the adoption of the report, stated that the undertaking was in a thoroughly sound financial condition. The total receipts for the year 1940 were £349,940 against a total expenditure of £329,380, leaving a surplus of £20,560 to be utilised on general improvements of the docks and sheds and the provision of appliances. During the year it became necessary to increase harbour rates and charges by 10 per cent.

New Chairman of the P.L.A.

In consequence of the retirement of the Right Hon. Lord Ritchie from the chairmanship of the Port of London Authority, which he has held from March, 1925, when he succeeded the late Lord Devonport, the Right Hon. Thomas Wiles, vice-chairman since 1934 has been appointed to succeed him. The new vice-chairman is Mr. Louis Hamilton Bolton, who was a member of the Board in 1927-28 and was again elected as a "vessels" representative in 1931, continuing as such to the present date. Mr. Bolton, who is connected with several shipping companies, is also a member of the Dover Harbour Board.

British Canal Transport.

In answer to a question in the House of Commons recently Mr. F. Montague, Parliamentary Secretary to the Ministry of Transport stated: "The investigation by Mr. Frank Pick into the carriage of traffic by canal is being pursued energetically and as a matter of urgency, but I am not yet in a position to say when it will be completed. I should like to make it clear that concurrently with Mr. Pick's enquiries all possible steps are being taken, by re-conditioning of barges and other means, to enable the canals of this country to make their maximum contribution to the war effort." He added that there was a question of re-conditioning of some canals as well as barges. "It is an old story," he said, "and one of great importance at the present moment."

New Panama Canal Locks.

The new locks on the Panama Canal, according to reports from Washington, U.S.A., are to be constructed of such a size as to accommodate battleships of up to 65,000 tons.

Nairn Harbour Repairs.

The Nairn Town Council are awaiting receipt of an intimation from the Treasury that a grant in aid is available for the Nairn Harbour Repair Scheme which is estimated to involve an expenditure of rather more than £1,000.

Proposed Icebreaker for Norwegian Port.

It is announced in the Oslo press that a new powerful icebreaker is proposed to be provided for the harbour of Svalfard (Spitsbergen). The vessel will have a tonnage of about 3,500 and machinery developing between 6,000 and 7,000 horse power.

Port Dedication Day in New York.

April 30th was set apart in New York, U.S.A., as a day of "Port Preparedness Dedication," with the object of securing the most extensive public recognition of the vital rôle played by the Port of New York in the national economy and defence proficiencies.

Glasgow Port Labour.

Following the rejection of the Government scheme for registration of port labour, both at a mass meeting of the workers and in a subsequent ballot, the Ministry of Transport issued a memorandum stating that the workers must either accept the scheme or cease to be employed. From March 15th, the Ministry became the sole employer of labour at the port until the end of the war.

Proposed Wharf Extension at Staten Island.

An extension of the wharves of Staten Island, New York, has been placed out to contract in an amount of about $265,000. The alterations planned involve the addition of approximately 225-ft. to the outer end of the present outer south wharf, the addition of a similar section to the present outer northwharf, and the construction of a 510-ft. wharf, to be joined to the present north wharf.

Panama Canal Traffic.

Shipping passing through the Panama Canal during 1940 totalled 5,058 vessels, of 22,766,832 tons net (Panama Canal measurement), carrying 26,546,579 tons of cargo. These figures show a decline of approximately 15 per cent. in the number of transits, of 16 per cent. in tonnage, but of only 10 per cent. in the cargo carried, compared with the previous year when the traffic amounted to 5,928 vessels, of 27,123,183 tons net, and 29,081,360 tons of cargo.

Re-opening of Polish Canal.

A Berlin paper has announced the re-opening of the 25-mile stretch of canal in North-West Poland linking the inland waterways of Poland and Germany. The sluices of the canal between Naklo, on the Notec River, and Bydoszez, blown up by the Poles in September, 1939, have now been repaired, states the report. The canal is old and the section between Bydgoszez and the Vistula takes only ships of 250 tons, but the Germans are planning to enlarge the canal to take ships up to 1,000 tons.

Mechanised Equipment at Auckland.

News has recently been received from New Zealand that in order to facilitate the handling of cargo at the wharves, the Auckland Harbour Board has decided to purchase additional mechanised equipment, comprising 5 tractors and 30 trailers, at at estimated cost of £3,500. The Board's action is a sequel to informal conferences held between the chairman, the New Zealand Minister of Labour and the chairman of the Waterfront Control Commission.

Swedish Port Dues.

Swedish, no less than British, ports are feeling the effects of war on port finance. The revenue from harbour dues at the port of Gelfe, for instance, is estimated to have fallen during 1940 by over half-a-million kroner and even worse results are anticipated in the current year. A petition has been presented to the Swedish Government to approve a proposal for an increase in port dues.

Port of London Authority.

The following re-appointment of representatives on the Port of London Authority have recently been made:—by the Admiralty, Admiral Sir Frederick C. Learmouth, K.B.E., C.B.; by the Corporation of Trinity House, Captain P. N. Layton, C.B.E., R.D.; by the London County Council, Sir Alfred Baker, D.L., J.P., Sir Bertram Galer, D.L., J.P., T. W. Condon, Esq., O.B.E., and Admiral Sir Alan Hotham, K.C.M.G., C.B.

Yantlet Dredged Channel in the Thames Estuary

A Contribution on Hydrographic Research and Development

By Commander E. C. SHANKLAND, R.N.R., F.R.S.E., F.R.Met.S.
River Superintendent, Port of London.

(Concluded from page 122)

Tidal Predictions and Calculations

The improved degree of accuracy which the Port of London Tide Tables now show has been secured by careful supervision of our automatic tide gauge at Southend, Tilbury and Tower Pier. These gauges provide the dimensional data upon which predictions are founded.

Tide gauges have existed for hydrographic purposes for many years. For the pilotage of the deeper vessels special tide gauges have recently been installed. These several installations may be separated into three categories:—

1. Automatic gauges recording graphically the rise and fall of tide at suitable river stations, for hydrographic purposes.
2. Automatic gauges recording the artificially controlled river or dock levels, as at Richmond Lock and Royal Albert Dock.
3. Visual natural range gauges for pilotage, night or day, the visibility of the figures being about ¼ mile, showing to the navigator the changing tide level continuously.

The history of tidal recording in the Thames is disconnected but interesting.

Probably the earliest recorded attempt at tidal prediction refers to the Thames, found in the Codex Cottonianus Julius DVII, at the British Museum. This work contains calendar and other astronomical or geographical information, some of which are the production of John Wallingford, who died Abbot of St. Albans in 1213. At page 456 a table on one leaf shows the time of High Water at London Bridge, thus—" flod at london brigge."

AETAS LUNAE		h.	m.
1	...	3	48
2	...	4	36
3		5	24
...	...	...	...
...	...	...	...
30	...	3	0

In this table, column 1 gives the moon's age, columns 2 and 3 the time of high water corresponding to the age. It is evident from this table that the time of high water at London Bridge has advanced about one hour since the thirteenth century.

Flamsteed, the Astronomer Royal in 1683, friend of Isaac Newton, published a table giving times of high water at London Bridge, and so through the ages there have been tidal records of the Port of London. In 1800, Parliamentary powers were sought for the building of a dock adjoining the Pool of London when a statutory local tide level was fixed, namely, Trinity Standard. Observations were then made by a committee of the Trinity House. This Committee appear to have chosen the new moon of the 20th August in that year with a meridian passage of 10 hrs. 20 mins. a.m. G.M.T. The range of this tide was measured and found to be 18-ft. 3-in. below the level of the high water. This dimension was used for guidance in constructing the dock entrance, and a stone which commemorates and established this tidal reference exists near the Shadwell Dock at present.

Trinity High Water has come to be regarded as a horizontal tidal zero of approximately Spring Tide Level throughout the River. The statutory declaration, however, clearly intended it to be of local application only and it refers carefully to the adjustment necessary if applied to other parts of the River where the level and range would differ from the Pool of London.

Automatic gauges were apparently first tried at the Port of London in connection with further building operations for new docks. Old London Bridge, which acted as a dam to the Thames by reason of its many arches and piers, was removed in 1827 and the present one built. In order to obtain a continuous register of the changed behaviour of tide Mr. Palmer, the Engineer to the London Dock Company, established his automatic tide gauge there in 1831. Mr. Bunt, a few years later, produced a similar machine of his own design for the Port of Bristol.

In 1833 the Admiralty initiated what is now a world-wide practice by forecasting the tides of London, Sheerness, Portsmouth and Plymouth.

In 1892 the Thames Conservancy introduced a clockwork gauge to record the levels at Richmond Lock. This gauge, made by Légé & Co., remained until 1923. When later the Port of London Authority was formed in 1909, attention was given to tide gauges due to the great waterway dredging scheme then contemplated. Approximately 55 million cubic yards of material in situ have since been removed from the river bed. This approximates in quantity to the first cut through the Isthmus of Suez.

The year 1912 saw several automatic gauges installed for the surveying and extensive dredging programme of the new Port Authority.

Before proceeding to describe the automatic gauges erected by the Port Authority from 1912 onwards, a description will be given of the first automatic gauge invented by Henry R. Palmer in 1831/33, when engineer to the dock under construction. The details were obtained from his paper read before the Royal Society of London by J. W. Lubbock (Phil. Trans. Volume 121, 1835). Its mechanism consisted of a float resting upon the water in a well protected against tide undulations by wire gauze. The method of suspension was by chain passing twice around a light cast-iron vessel, and provided with a counterweight. The chain of this counterweight was of such a length that both ends were always resting on the ground. A light horizontal shaft with bevel wheels was geared to an upright shaft which acted on the pencil rack. The pencil moved backwards and forwards, making its impression on graduated paper held on a drum rotated by a clock. The cylinder carrying the graduated paper had on its axis a large toothed wheel which received its rotation from the clock shaft. To control the revolutions a cam wheel, having six teeth, then raised a hammer striking the impression once in every hour so that the spaces passed through were measured as they occurred obviating any error due to expansion or contraction of materials.

Mr. T. G. Bunt's tide gauge erected at Bristol on the tidal River Avon in 1837 followed similar principles, viz.:—

An eight-day clock turning a vertical cylinder revolving once in 24 hours.

A float rising and falling with the tide, operating a pencil to scribe the tidal curve through special gearing.

The history of artificial estuarial development shows that as dredging proceeds in a narrow tidal river or as embankments are erected to confine the water to narrower limits, tidal changes occur. By dredging the River Tyne a deepening of 10-ft. was effected in about 50 years, thus the tide levels were changed considerably.

Likewise in the Port of London above Gravesend, the range of tide has altered materially due to widening and deepening the Channel over a period of 25 years. Embanking has also affected the tides by causing them to rise higher in certain parts of the waterway. We have therefore tidal complexity to consider.

Automatic tide gauges are essential to trace long period and short period effects. Mere recording of high and low water would not assist in tracing quarter-diurnal effects, for instance. These quarter-diurnals are very important in tidal research.

Throughout the tideway occasional perturbations occur in a marked degree. These are invariably due to severe meterological disturbances sometimes operating off the North-west coasts of the British Isles. The Straits of Dover appear to function as a sympathetic barrier to these tidal disturbances and the Thames Estuary being in close proximity registers these local reactions.

On 19th October, 1935, a large depression travelled from the Atlantic and on that date was centred over the North of Scotland. The disturbance of the tidal levels in the lower part of the North Sea was such that the tide wave in the Port of London lost for a period its normal character with the effects seen on the curves.

The Automatic Tide Gauge at Southend was made by Cary Porter and established in 1912. It is of the horizontal drum type, the float operating the pen, the clock revolving the recording drum one complete revolution in 24 hours. The gearing reduces the tidal movement to a record of half-an-inch to one foot vertical, and one inch to the hour horizontal, the scope being equal to a tidal range of 29-ft.

The automatic gauges at Tilbury, 17 miles, and at Tower of London Pier, 43 miles respectively landward of Southend are of the same design. The clocks, which are lever type, receive special attention owing to vibrations which are inevitable from vessels manœuvring in the vicinity. At Galleons Reach, situated 33 miles landward from Southend, an automatic electrical recorder established in 1912 is fitted to show by remote control the variations of water level in the Tidal Basin with reference to the river

Yantlet Dredged Channel in the Thames Estuary—continued

levels. These diagrams are visible to the control engineer in the pumping station. Its arrangements consist, for the river levels, of a wooden trunk 3-ft. by 3-ft. situated on the upper end of Galleons Jetty, a float having a diameter of 18-in. is connected with a counterweight by a copper wire passing over a grooved wheel, geared to a transmitter installed on the top and centre of the trunk. A unique feature of this trunk is the method of keeping it free from mud. The bottom consists of a flat iron plate pierced with holes, and moving over the plate, but in close contact is a steel wiper. To this wiper is attached a steel rod which runs to jetty level. The top end of the rod is squared to receive a key and a few turns of this causes the wiper to move over the plate, forcing the mud through the holes in the bottom and preventing general settlement.

A movement of 2-in. in the tide causes an electrical impulse to be transmitted along wires to the pumping station where the main instrument registers this rise or fall on the chart. Fixed to this instrument are two sets of induction coils, one for the rising tide, in which case the current causing the pen to move vertically to a scale of 2-in. and *vice versa* for the falling tide.

Photo] Barge Traffic on the River. [Stanley

A plate is fixed in the river trunk at a level of 5-ft. below T.H.W. Tidal contact with this plate causes a bell to ring in the pumping station, enabling the engineer in charge to check the accuracy of the gauge and to adjust as necessary.

For dock levels a similar transmitter, sets of receiving coils, float and counterweight are used. The greatest fluctuation in dock level is 2-ft. 6-in. compared with the maximum river range of 30-ft. The distance of the transmitter from the pumping station in the case of the river levels is some 600-ft. and in the dock level the distance is nearly half-a-mile.

Both the river and dock levels are recorded on the same tidal sheet which is fitted on a drum which revolves once in 24 hours and the record is changed daily. The drum is of the vertical type and consequently the pens move vertically.

The voltage used to operate this gauge is 20 volts and is supplied by a battery of 14 Léclanché cells.

From 1912, the date of installation of this gauge, to the present time, a chain passing over a sprocket wheel was used to link the float and counterweight to the transmitter, both in the case of the river levels and dock levels.

Considerable trouble was experienced by the stretching of the chain, but this chain has now been replaced by a flexible copper wire which is wound round a grooved wheel.

For determining the non-harmonic constants, we have recently examined the tidal slope at several points of the River for synchronising readings of the automatic gauges. From this diagram the position of maximum range of tide is clearly demonstrated as existing at Woolwich (King George V Dock).

Moreover, it will be observed that the face of the Tidal Thames is more frequently a changing sinuous surface than a direct slope.

The predictions of high and low water times and heights are based on the harmonic analysis and were previously obtained from the Old Swan Pier recordings for the year 1911-1912 and computed by Messrs. Roberts and Sons, Mr. Roberts having been a pupil of Lord Kelvin—the inventor of the predicting machine.

Early in 1926, inaccuracies having been noted by the tidal occurrences, a comparison was made by Roberts of the 1911-1912 figures with those of 1925 and it was found that during that interval the times of high water for Old Swan Pier situated above London Bridge had advanced 5-10 minutes and low water 3-5 minutes, also that an increase in the range of Spring tides had taken place. This acceleration of tide was probably due to dredging and other river improvements.

It should be noted that the Old Swan Pier tidal records had been used as the basis of tidal computations for the period mentioned and previously thereto. The situation of this gauge was unfavourable for tidal levels as the structure of London Bridge affected the levels so that on the ebb tide there was a slight lagging of the tide and on the flood, a weir effect, producing an untrue curve.

In 1926 the River Committee gave authorisation to transfer future tidal predicting to the Liverpool Tidal Institute, relieving the Authority from the uncertainty of private computing. The Tidal Institute at this time installed a much improved tidal predicting machine and was entrusted with similar tidal prediction problems for the British Admiralty and certain important commercial ports. It was found in 1929 when the revised values were received that the times of high and low water were still susceptible to improvement at London Bridge and to a smaller extent at Southend-on-Sea.

It was thereupon decided that the predictions required a broader period basis than one year's analysis. It was also proposed to use Southend, where the movement of the tide was free, as the major station instead of Old Swan Pier and consequently the records for the years 1926-1928 inclusive were analysed and form the basis of present-day predictions.

It was again proved in 1929 that the travel of the tidal wave between Southend and London Bridge had been with recent improvements accelerated by 4 mins. at high water and 8 mins. at low water, which was probably due to the removal of $1\frac{3}{4}$ million cubic yards by dredging in Woolwich Reach during the interval, 1925-1929. In 1931 it was further noticed that a constant difference was found between predicted tides and recorded tides for certain months of the year. The Tidal Institute was asked to investigate further and advised that corrections were necessary to the predictions for the years 1932 and 1933, reaching the maximum correction of 7-in. on the high waters and 6-in. on the low waters.

The recorded tides for the years 1933 and 1934 were again compared with those predicted, and it was found that 70% of the high water Springs were within 10 mins. of times and 65.9% within 6-in. of height and the Tidal Institute furnished the following comparisons:—

		Liverpool.	Avonm'th.	Southend.	London Bridge
High Waters.		%	%	%	%
Within 10 minutes of Predicted Time	1933	—	—	76.7	70.3
	1934	75	82.5	73.6	70.9
Within 6 inches of Predicted Height	1933	—	—	65.7	65.9
	1934	46	49.0	63.7	60.0
Low Waters.					
Within 10 minutes of Predicted Time	1933	—	—	61.8	66.7
	1934	72	80.5	64.6	65.2
Within 6 inches of Predicted Height	1933	—	—	5.10	46.3
	1934	42	37.0	6.54	60.6
Mean Range ...		20 ft.	28 ft.	14 ft.	18 ft.

From the above it will be noted that 1934 was not a great improvement on 1933 at Southend and London Bridge and this was pointed out to the Tidal Institute.

In 1936 the Tidal Institute thereon recommended that new analyses be made for Southend and London Bridge at regular periods every three years (in place of using one year) as is the practice at Liverpool, Avonmouth and Southampton and this was done, comparing 1934 with 1931. Should it be considered desirable the question of a further analysis after this period could of course be reviewed.

During 1939 further comparisons of the actual 1938 tides for London Bridge and Southend were undertaken with the results shown below, using the 1922 figures of Mr. Roberts for comparison, the first year that re-analysis was ordered:—

High Waters.		*Southend.*	*London Bridge.*
		%	%
Within 10 minutes of Predicted Time	1922	58.6	68.9 Old Swan Pier
	1938	81.4	72.2 Tower Pier
		22.1 Improvement	5.3 Improvement
Within 6 inches of Predicted Height	1922	61.6	57.2 Old Swan Pier
	1938	60.6	55.6 Tower Pier
		1.0 Difference	1.6 Difference

Yantlet Dredged Channel in the Thames Estuary—continued

Low Waters.			
Within 10 minutes of Predicted Time	1922	56.7	53.3 Old Swan Pier
	1938	64.0	66.0 Tower Pier
		7.3 Improvement	12.7 Improvement
Within 6 inches of Predicted Height	1922	65.1	52.5 Old Swan Pier
	1938	67.0	62.4 Tower Pier
		1.9 Improvement	9.9 Improvement

Tidal Conclusions

The triennial examinations should further improve the difference between predicted tides and the actual occurrences. The establishment of Southend as the standard for comparison should also increase the general accuracy.

Further embanking of the Thames such as a wall from London County Hall to Blackfriars Bridge in the narrow City reaches of the River would tend to raise the high waters in the Pool of London. In effect, the following are the approximate changes:—

London Bridge

Level of Low Waters has fallen 1-ft. 7-in. in 100 years
Level of High Waters has risen 11-in. in 100 years.
Increase of range in 100 years 2-ft. 6-in.

Acceleration of tidal wave in 100 years. Between Southend and London Bridge in amount is as follows:—

Times of Low Water have advanced 31 mins. in 100 years.
Times of High Water have advanced 38 mins. in 100 years.

Dredging Plant

Dredger No. 3 A. A steel non-propelled centre well dredger, 1,810 tons displacement. Built by Fleming & Ferguson, of Paisley, in 1906.
Two sets of buckets, one of 20 cu. ft. and the other of 14 cu. ft.; 350 i.h.p.
Total cost (new) £35,550. Dredging depth 50-ft.

No. 4 B. A steel non-propelled bow well dredger, 898 tons displacement. Built by Fleming & Ferguson, of Paisley, in 1911.
Bucket capacity of 10 cu. ft.; 225 i.h.p.
Total cost (new) £22,353. Improved dredging depth 60-65-ft.

No. 5 C. A steel non-propelled bow well dredger, 898 tons displacement. Built by Fleming & Ferguson, of Paisley, in 1911; 225 i.h.p.
Total cost (new) £22,353. Dredging depth 45-ft.

No. 7 D. A steel non-propelled bow well dredger, 1,760 tons displacement. Built by Lobnitz, of Renfrew, in 1911; 453 i.h.p.
Bucket capacity of 27 cu. ft.
Total cost (new) £42,614. Dredging depth 55-ft.

No. 6 E. A steel non-propelled bow well dredger, 1,760 tons displacement. Built by Lobnitz, of Renfrew, in 1913; 453 i.h.p.
Bucket capacity of 27 cu. ft.
Total cost (new) £42,614. Dredging depth 55-ft.

To those vessels marked A, D, E, fell the work of raising four million cubic yards between 1923 and the date of final completion. The cost worked out at approximately 1.25 shillings per cube yard, inclusive of depositing at sea.

Heavy weather created delays in performance and on several occasions the steam hoppers were required to circle around the bucket dredgers pouring oil in the sea surface to calm the breaking water until the storm subsided.

Wrecks of vessels sunk and destroyed were encountered in the dredging but the massive strength of dredgers D and E were able to cope with the metal and framework encountered.

Altogether four such wrecks were demolished by the dredgers.

Current Observations

Comparison between Flood and Ebb Tide Current Observations in the Yantlet Channel, taken at a level of 1-ft. above the river bed level. Period 13th-16th December, 1938.

Position in Yantlet Channel	Times relating to time of Low Water		Speed in knots		Tidal level at Southend above Low Water datum	
	After	Before	Flood	Ebb	Flood	Ebb
					Mean of Spring and Neap Tides.	
	Hrs.	Hrs.			ft. in. to ft. in.	ft. in. to ft. in.
Mid-way ...	1½	1½	1.4	1.0	5 1 to 5 8	3 5 to 3 1
Do. ...	2	2	1.7	1.3	5 8 to 6 4	4 5 to 4 2
Do. ...	1½—1¾	1¾	1.4	1.2	5 1 to 5 8	4 2 to 3 8
Western End...	2¼	2¼	1.6	1.4	6 4 to 7 4	4 7 to 4 5
Do. ...	2¼	2¼	1.6	1.5	6 4 to 7 4	5 9 to 5 0
Do. ...	2¾	2¾	1.8	1.7	7 4 to 8 9	6 7 to 5 9
Do. ...	3	3	1.8	1.7	8 9 to 9 7	7 3 to 6 7

NOTE.—(1) The stronger force of flood tide in all positions.
(2) Surface currents may exceed in velocity, the bottom velocities by 90%.

Marking and Navigational Directions

From 1797 until 1925 the Nore Lightship had occupied a position which led shipping into the River Medway rather than into the Thames because of the associations with the Royal Navy in past times with the Medway. With the development of other naval bases and the commercial rise of the Port of London the General Lighthouse Authority decided on the completion of the Yantlet Dredged Channel to alter the position of the Nore Lightship to where it now serves as the leading mark for the traffic proceeding into and out of London. At the same time the channel now dredged was rebuoyed at intervals approximately

Photo] The Pool of London. [Stanley

equi-distant so that the navigator entering from seaward is guided by a series of buoys—

First, No. 1 Buoy showing 1 flash.
Second, No. 2 Buoy showing 2 flashes.
Third, No. 3 Buoy showing 3 flashes.
Fourth, No. 4 Buoy showing 4 flashes.

At each buoy there is a slight alteration of course due to the sinuous character of the dredged channel.

In this waterway the buoys are placed in the centre of the channel, a style of marking preferred by pilots because at half tide the margins extending to 500-ft. on either side provide a depth of 34-ft. and enable the wider navigation to be used as requisite.

The Name of the Channel

"Yantlet" is a name associated with a creek in this neighbourhood and was a short cut into the River Medway from the River Thames taking its origin from the Old English Gegnlad—a backwater. This creek has filled up and is not now fully navigable. In the Cartularium Saxonicum under the following dates 779 A.D., 789, 808 A.D. this name appears. With such an old identification spreading to the banks and vicinity the central dredged channel in Sea Reach therefore takes its name.

Conclusions

No fundamental laws have been assailed or the aid of expensive training walls invoked. The estuary remains free in the hydraulic sense. Since the original dredging, natural scour has increased the depth from 30-ft. to 32-ft. 5-in. (mean of all sections) and the natural gain from scours since the channel was formed by dredging exceeds 3½ million cubic metres.

The prospect of future self-maintenance appears satisfactory and the relation of length to width and depth is apparently in sympathy with nature.

Yantlet Dredged Channel—continued

The geographical position which placed this development where the flood and ebb streams are nearly equal in duration has proved to be no disadvantage and the dissipation of tidal energy of the ebb tide due to the bellmouth has been partly counteracted by the stability of the channel bed which collects and contains the stream on the last and vital quarter of the ebb tide, without erosion of the sides.

Owing to its curvature and alignment the channel collects the full vigour of the flood stream which also helps to maintain depth, being on the average stronger than the ebb.

Those responsible for estuarial management may therefore find in this Thames research some data of service to them in coping with the problem of free flow and artificial channel development.

Port Operation in the National Service

Proposals for Greater Efficiency and Economy

The Select Committee appointed to examine the current expenditure defrayed out of moneys provided by Parliament for the Defence Services, for Civil Defence and for other services directly connected with the war, and to report what, if any, economies consistent with the execution of the policy decided by the Government may be effected therein, have issued the following report, the tenth of the series:—

The Handling of Shipping in Home Ports

The Sub-Committee have heard much evidence on the urgent problem of handling shipping in the home ports. The importance of securing the most rapid " turn-round " of ships (i.e., unloading and reloading) cannot be over-stressed. There have been many allegations and criticisms of time lost at the ports, some of them well founded, but many ill-informed. To remove misconception in many quarters, the Sub-Committee find it necessary to make it clear that on the arrival of ships at home ports, and until they sail again, the Ministry of Transport, and not the Ministry of Shipping, is responsible for the discharge and loading of cargoes. The Ministry is also responsible for clearing the ports of goods, and it is here more than anywhere else that congestion persists. Warehouses and quays get filled to overflowing, and there is room neither to accommodate the mass of incoming cargoes, nor the flow from inland of goods to be shipped. The convoy system itself brings an abnormally large tonnage to certain ports which unavoidably makes for congestion. Therefore a larger exhaust pipe than normal is required if the ports are to be emptied rapidly. Enough has been said to show how manifold are the problems of the Ministry of Transport and the railway systems at a time when the latter are already overloaded with inland industrial traffic.

It has been said, and the Sub-Committee believe it to be true even in present circumstances, that " the ship will always beat the shore." This means that a ship can always be unloaded and loaded again more quickly than transport can take traffic from, or bring traffic to, the ports. It does not follow, however, that there are no defects in handling cargoes to and from the ships in port. The Sub-Committee are satisfied from evidence received that there have been, and still are, delays in these operations which could be shortened. This is mainly a question of handling. First, as regards dock labour, the efficiency of labour varies between port and port. In some ports there is evidence that the workers knock off work during " alerts." This is less to be condemned after dark when men are anxious to get back quickly to their families if hostile air attack threatens. There is, however, evidence that work also ceases during periods of "alert " in daylight. There have been cases when men have not sought shelter, but have lounged about, or have even played cards on the decks. It is but fair to say that such behaviour has been strongly discountenanced by the Trade Union leaders with good effect in some ports. If, as the Sub-Committee have been informed, the most profitable daily period for efficient working is 16 hours, it follows that there should be no cessation of work during these hours unless danger is real and imminent.

Another cause of delays has been the practice prevalent in some ports where dock workers have been able to pick and choose the cargoes they will handle. It is understood that this practice will disappear under the scheme now being organised whereby dock labourers are to be assured of a minimum weekly wage, with opportunities of supplementing this wage by overtime. This plan should also banish absenteeism which has been another cause of delays. It seems that there are dock labourers who, when they have earned what is in their opinion an adequate amount, absent themselves from duty. The Sub-Committee do not wish it to be understood that the complaints to which they have just referred are general at all ports, for conditions and practice have been variable. One distinct deterrent to obtaining overtime and extra services is that the facilities for obtaining hot and other meals and periods of rest at some ports are either altogether absent, or are capable of considerable improvement, including transport facilities. Where provided, they are undoubtedly an encouragement to workers to give better service. The Sub-Committee, therefore, welcome the attention which, it is understood, is to be given to these important matters.

The reorganisation of the conditions under which labour is to be employed and remunerated at the ports will, it is expected, increase the cost of handling cargoes. It is understood that this reorganisation will be the task of the Ministry of Labour, but that the actual employment of labour will be the responsibility of the Ministry of Transport, who will charge out to the companies and undertakings thus served the cost of providing labour service. If, however, the speedier turn-round of ships is thus secured, and if the accumulation of merchandise at the docks can be cleared by the railways, then the increased cost of labour may be fully recouped.

The great overload thrown upon certain ports has found some of them insufficiently equipped with powerful cranes and elevators for the efficient handling of freight, much of which is abnormal in quantity and in type to the ports now handling it. The Sub-Committee feel that they are not making an unreasonable criticism in suggesting that this might have been foreseen, and earlier steps taken to secure the existence of equipment which could be transported to, and erected at, the places where its need would arise. While it is often easy to be wise after the event, it surely needed no great stretch of imagination to forsee earlier and probable happening of events which have transferred the handling of shipping from accustomed to unaccustomed ports. When the need of additional mechanical equipment became obvious for ports at which it did not exist, steps were promptly taken to place orders for larger cranes, etc., but possibly not on as high a priority as would meet the urgency. The Sub-Committee recommend that all possible steps be taken to speed up the manufacture and delivery of this urgently-needed mechanical equipment and the transfer of existing suitable equipment, the use of which will have valuable time and lessen the strain on the available supply of manual labour.

To evacuate the ports rapidly, there is already a pressing need for more railway wagons of special types. The type of import has in some important respects changed. Much fabricated material of greater length and heavier weight is now obtained from overseas. This class of cargo can only be handled conveniently on the railways in wagons of special type. Some of these are building. The need for them is urgent. Their manufacture, too, should be speeded up.

It is understood that the Minister of Transport has under consideration a scheme for organising a pool of road transport lorries to be used as a piece of Government emergency machinery. This pool may prove of material assistance in evacuating freight from congested ports, although there is an obvious limit to the use of lorries in this respect as compared with railway wagons. Nevertheless, material help may be possible in moving considerable quantities of the lighter type of cargo which would otherwise occupy space, without much weight, in railway wagons.

Before passing from the handling of shipping in ports, the Sub-Committee would repeat what they have now explained, that, in view of the additional responsibilities cast upon the Ministry of Transport in war-time, the particular responsibility for the more rapid turn-round of ships falls mainly upon that Ministry. This does not mean that the Ministry of Shipping are divorced from all responsibility as to what happens to their ships while in port, nor are the owners of many such ships relieved of all responsibility. It is the interest of the Ministry of Shipping and of shipping owners to see that ships are loaded and unloaded as rapidly as possible, and to make suggestions where delays may be avoided, and handling speeded. At all the more important ports, " Port Emergency Committees " are in operation. On these committees are representatives of the Port Authorities, Rail, Road, Labour, Employers, Traders, the Ministry of Shipping, and Overseas Shipping Owners. It may be said that these large Emergency Committtees are too unwieldy for rapid action or advice, and that too much consultation is involved where rapid action is vital. It is for this reason that certain appointments of Regional Port Directors have been made by the Minister of Transport. These Directors will, in effect, represent the Minister himself at the ports. The main purpose of their appointment is to enable quick decisions to be given where conflicting interests may arise. From the evidence they have received, the Sub-Committee have to report that these appointments have been welcomed as sound in principle. Time alone will show whether they have succeeded in their objective, and whether the appointment of some men as Regional Port Directors, without previous experience of all the ramifications of shipping and port management, is likely to bring success in discharging adequately and efficiently the very onerous responsibilities involved in securing the rapid clearance of both ports and ships.

The Handling of Shipping at Overseas Ports.

The Sub-Committee have made enquiry into the possibility of delays in the turn-round of ships while in overseas ports, and they are glad to be able to report that there would appear to be little

*Extracted from the Tenth Report from the Select Committee on National Expenditure. Printed and Published by H.M. Stationery Office. Price 2d.

Port Operation in the National Service—continued

of which to complain in this respect. It is true that bunkering at some coaling ports has been made impossible, since the subjucation of France. Apart from this, there is only one other matter to which attention might be directed.

It has been pointed out, with obvious truth, that great advantages would follow the loading of ships overseas with materials which could be unloaded at one port at home, thus averting the risk of having to send the ship to more than one port for unloading. It has also been suggested that greater discrimination might be shown at the ports of overseas loading in selecting cargoes for ports of delivery which entail the shortest inland transport after delivery. In other words, the transport problems at home are made more difficult if, say, 50 per cent. of a ship's cargo should obviously be unloaded at a western port, and the other 50 per cent. is destined for, say, Hull. Further the Sub-Committee were told of one case where a certain dock was littered with packing cases containing machine tools, the destination of which was unknown. In view of the great urgency there has always been for machine tools, it seems inexcusable that such an event should have been allowed to occur. The Sub-Committee understand that, whereas the Ministry of Shipping have experienced representatives at the most important overseas ports, the Ministry of Transport are not so represented, and yet it must be repeated that that Ministry is responsible both for the unloading of cargoes on arrival at home ports and for transmitting them inland to the establishments of consignees wherever situated. The Sub-Committee, therefore, suggest that the possibility of closer co-operation between the Ministry of Shipping and the Ministry of Transport at overseas ports be investigated with a view to the better organisation of the types of cargo to be shipped in one vessel, having regard to ports of arrival and subsequent inland distribution.

Delays Due to Customs Formalities

The Sub-Committee have noted complaints as to the delays in getting consignments of goods away from the docks owing to the necessity for complying with the requirements of H.M. Customs. They have made enquiries and find that, although some steps have been taken whereby goods may be transported inland and be there examined by the Customs officials, there is much more that can be done in this respect which calls for immediate remedy. They, therefore, recommend that this matter be treated as one of urgency. In view of the fact that so much that is imported to-day is on Government account, there can be little doubt that much Customs examination now being enforced might be relaxed and thus facilitate the urgently needed transfer of goods from docks to inland destinations.

Conclusion

The Sub-Committee have heard enough evidence to convince them that in order to improve the use of shipping the crying need is to speed up the passage of goods through the ports, and that this is not a shipping but a transport problem. They feel that this statement is abundantly confirmed in the foregoing paragraphs of this Report. Essential as may be the steps now being taken to handle incoming and outgoing ships' cargoes with greater celerity, the success which may thus be achieved will obviously be frustrated if by the continuance of transport difficulties the only result is still further congestion at the ports. The Sub-Committee feel that in matters so vital to the successful prosecution of the war, to national economy, and to the feeding both of industry and the people, they would fail in their duty if they did not urge that attention should be concentrated on the transport problems involved, and every practicable step taken to resolve them. In the Committee's Eighth Report of the present Session, they recommended for consideration the withdrawal of passenger traffic on specified days to enable more freight trains to be moved. Other countries have not hesitated to act in this way when the congestion of freight or military traffic has required it. This country has never before had such unprecedented burdens thrown upon its transport system, the consequence of unprecedented circumstances. It has been said that "desperate situations require desperate remedies," and, in view of the Sub-Committee, the responsibilities thrown upon the Ministry of Transport are already so heavy, and may easily become so much more aggravated, that only new and drastic methods can lessen the present strain. They, therefore, recommend that immediate consideration should be given by the Railway Executive under the instructions of the Ministry of Transport to drastic reductions in the passenger services on specified days.

Summary of Recommendations as regards Port Operation

There should be no cessation of work in ports during "alerts" unless danger is imminent.

Delivery and/or transfer of additional mechanical equipment for ports should be speeded up.

Manufacture of railway wagons of special types should be accelerated.

Closer co-operation at overseas ports between the Ministries of Shipping and Transport should be considered, in order that cargoes may be more suitably arranged with a view to their ultimate destinations.

Customs examinations of goods should be relaxed to allow ports to be cleared more quickly.

Every practicable step should be taken to overcome transport difficulties, and particular attention should be directed to the possibility of curtailing passenger trains on the railways on specified days.

NOTE.—Your Committee are glad to note that in the interval between the drafting and passing of this Report, action on some of its recommendations has been taken.

Notable Port Personalities

X.—*Mr. John Douglas Ritchie*

Mr. John Douglas Ritchie, General Manager of the Port of London Authority, was born near Manchester, of Scottish parentage, in 1885. He was educated at Manchester Grammar School and Manchester University, and was articled to the firm of Alfred Grundy, Son and Co., solicitors, of that city. In 1908, he was appointed as a legal assistant with the Manchester Corporation, and about four years later became assistant solicitor to the Stoke-on-Trent Corporation. In 1913, he was selected for the position of Deputy Town Clerk of Burnley, which position he

Photo by] ["Modern Transport"
Mr. JOHN DOUGLAS RITCHIE.

retained until January, 1920, when he became Town Clerk of that borough. In 1923 he was appointed Solicitor to the Port of London Authority, and in 1927, when the duties of Secretary to the Authority were combined with those of Solicitor, Mr. Ritchie was given the dual appointment. On January 1st, 1938, he became Deputy General Manager of the Authority, and from June 1st he served as acting General Manager.

Since the outbreak of war Mr. Ritchie has ably carried out the responsibilities of the two most important posts in the Port of London in war-time. As General Manager of the Port of London Authority he has shouldered the normal obligations and duties of that Undertaking and as Chief Executive of the London Port Emergency Committee he exercises wide powers conferred by the Minister of Transport to secure the efficient operation of the Port of London as a whole.

Mr. Ritchie is Honorary Treasurer of the Executive Committee of the National Council of Port Labour Employers and a Member of the "London Ten" (Port Employers in London). He is also a Member of the Honorary Committee of Management of The Incorporated Thames Nautical Training College and of the Management Committee of the Poplar Hospital for Accidents.

During the war of 1914-18, Mr. Ritchie saw active service in France with the 4th Gordon Highlanders and the Tank Corps, and was awarded the Military Cross. He holds the rank of Lt.-Colonel in the Engineer and Railway Staff Corps, R.A. (T.A.).

In less strenuous times Mr. Ritchie's favourite recreations are hunting and golf, and he takes a keen interest in the sporting and recreative activities of the staff of the Port of London Authority.

The Falsterbo Canal.

An expenditure of 41½ million kroner has been sanctioned to complete the new canal across the Falsterbo Peninsula in Southern Sweden. Under normal weather conditions it is expected that the canal will be available for traffic by the beginning of August.

Harbour Fauna and their Influence in Port Waters

Gulls, Mud Bank Animals, Alien Importations in Water Ballast Tanks

By ERIC HARDY, F.Z.S.

The changing fauna of harbour waters and estuaries has been more noticeable in recent years with the increasing attention given to marine biology, although apart from the work of the Department of Industrial and Scientific Research the bulk of this type of study has been for purely scientific aims independent of shipping facilities. It has, however, raised the issue in many quarters about the increasing population of gulls inhabiting all our harbours, which have probably trebled their numbers during the present century with a noticeable increase of all species. A recent national census of the nesting population of the common black-headed gull revealed some 150,000 nesting birds annually, while in the winter months there is an immense immigration of these, and common gulls, from the Baltic countries of Northern Europe. Many thousands of the bigger herring-gulls and black-backed gulls also inhabit our harbours, and observations I have made at Liverpool show that much of the winter gull population at the port is static, for an immature herring-gull marked with a leg-ring in the autumn was still there in the new year.

Apart altogether from purely popular interests, harbour gulls have to their disadvantage the habit of defacing buildings, warehouses, mastheads and rigging with their droppings, necessitating extra expense and labour in painting; their habit of pilfering unattended perishable goods, particularly fish and fruit, and the often suggested but very unlikely risk of contamination from their frequent feeding at sewer outlets and rubbish tips. In the first and second complaints they share responsibilities with dockland pigeons, which are feral forms of domestic pigeons from the towns, heavy feeders upon grains and a serious pest in defacing buildings, their only asset being their food value. Rats are far more destructive than gulls to perishable goods, and starlings probably carry a larger risk of transmitting bacteria of a harmful nature. On the other hand the gull has its advantages, which, from the harbour position, outweigh its disadvantages. As a scavenger of waste and offal it has no equal and the gull population saves all harbour authorities a considerable expense, particularly in regard to the tide line. The great black-backed gull and the great skua even go so far as to devour the dead dogs and cats, dead sheep and bird corpses so frequently washed up on the tide, for the remains of these carrion are frequently found in their stomachs.

In war-time the gull flocks have a further advantage in quickly locating a drifting mine, or an emerging submarine, and congregating in a noisy flock above the strange object to the obvious notice of any watcher ashore. No other estuary birds have this habit, and in point of fact none of the other birds like cormorants, redshanks, etc., has any influence upon port facilities, unless it be the cormorant's fondness for resting on black buoys and disfiguring them with droppings. Dazzled migrant birds crash at the lanterns of lighthouses showing a white light, but not those showing a red light.

The remaining biological influence comes from the small marine creatures that live in the mud and sand banks and have some effect upon their stability in the channels, and those which bore into submerged timbers or fix themselves to marine structures and impede their efficiency. The growths of mussels, barnacles, and other creatures fixed to the pontoons beneath a floating landing stage may necessitate frequent flushing to reduce their numbers unless they can be poisoned with copper or mercury compounds. It is difficult to prevent these animals, and also the *Enteromorpha* or grass-like algae, from gaining a footing upon stationary submerged objects, although hard green paints with a strong smooth finish, of a chlorite-caoutchouc composition, or chromium steel, or copper, reduce the rate of colonisation. The majority of the mussel beds in commercial waters have been condemned as unfit for food because of this animal's habit of retaining material from the water it uses in respiration, but the possibilities of turning to commercial account, the mussel beds of harbours cannot be overlooked in view of the success of the Conway experiments of fattening mussels upon sewage and then making them fit for human consumption by a cleansing process.

With regard to the fauna of the sand and mud banks bordering river channels, it is not so much that these animals make a bank stable or unstable—that is, of course, the work of the currents, and any harbour structures that alter the currents—but that they mark the two types of banks. Marine animals living in the river bed do not show such a preference between mud and sand as they show between stable and unstable banks, and the former hold a much larger population than the latter. Usually only a few lug-worms inhabit unstable sand banks in the estuary or off the surrounding coast, occasionally the small mollusc (or " shell fish ") *Macoma Calthica* will share the site. But stable sand is densely populated with crustaceans like *Corophium volutator* and shell fish like *Macoma*, small tube-building worms like Pygospio elegans, and ragworms. In the stable mud banks rag worms are probably the most numerous animals with an abundance of *Macoma, Corophium*, and the small red worm *Clitellio arenarius*. Burrowing animals are much more abundant in sand than in shingle and cockles are sometimes very abundant in stable sand banks or in stable mud.

These creatures probably help to fix the mud against slight erosion, but they have none of the fixing effect of plants like *Spartina Townsendi*, the rice or cord-grass, or " sniggle." They are in many cases increased by the depositing of crude sewage into a river estuary or a harbour, for there are many of their food sources therein, and the sewage increases the settling rate of mud banks and suspended matter in the water. This settled material is but lightly attached and is easily dispersed again by tides and currents, and the official investigation of this problem in the Mersey Estuary under the supervision of Dr. Southgate showed that the sewage concentration in this famous tidal water had no appreciable effect on mud bank formation, or the hardness of the banks, although it has much influence upon the marine fauna. I noticed some years ago that the periwinkles in the estuary look almost a distinct variety, for their normal banding is completely hidden by the grey-green growth of algae.

Nest with chick and eggs of the lesser black backed gull, near Liverpool.

The high population of marine animals has a somewhat similar effect upon the control and reduction of sewage as has been noticed at inland sewage farms where numerous creatures effect an important biological control and maintain a balance of animal life necessary for the normal functioning of sewage disposal. Also the tide runs slightly slower over mud banks compared with sand banks, because these are a little higher.

An important effect upon the fauna and flora of harbour water may arise from the water ballast tanks of ships which can introduce new animals and plants, in larval or seed form, from foreign countries, which may prove of immense importance. *Spartina Townsendi*, the cord grass or sniggle which originated as a hybrid between British and American Spartinas, was probably the outcome of the American Spartina being introduced to Southampton water in the water ballast tanks of ships, when it rapidly spread by vegetative reproduction.

The Chinese mitten or woolly-clawed crab, transporter of the fluke worm causing a human lung disease, and a serious competitive factor with inshore fisheries, was probably introduced to the Elbe and most other rivers of Western Europe where it now swarms in its larval stage in the water ballast tanks of ships from the Orient, for the larval crab is microscopically small. This crab was found at a Chelsea power station in 1932, in water pumped from the Thames. The mitten crab is about the size of the common green shore crab, but with a curious hair-like growth upon its large claws. These crabs are very active and will journey some distance up-river, burrowing into the banks and undermining them. In China they have travelled some four hundred miles up the Yangste and other big rivers. The risk of these crabs introducing disease to this country is remote, but there still is the danger of the colonies in the Continental estuaries of Germany and Holland spreading with serious economic results.

Hull Conservancy Board.

Mr. J. Bentley Bennett, of Goole, has been re-elected chairman of the Humber Conservancy Board, and Mr. W. Minnitt Good, of Hull, elected vice-chairman, to fill the vacancy caused by the resignation of Mr. Ernest Sutcliffe.

*Ships' Cargo-Handling Gear**

By L. T. MORTON, B.Sc.

Synopsis.—The reasons are given why cargo-handling gear should receive due consideration in addition to the propelling machinery when designing a cargo winch to enable the most economic arrangement to be provided for any given service, from the points of view of first cost, running cost and cost of upkeep.

The available types of motive power for cargo handling are described briefly, with their advantages and disadvantages which result in the choice being in nearly every case narrowed down to that between steam and electric winches. The relative merits of these two types in general are described in more detail.

The various forms of steam and electric winches available are briefly mentioned with their outstanding features and their effect on the economy of a ship.

Mention is also made of derrick arrangements in general, and heavy-lift derricks in particular.

Introductory Note.

BEFORE reading this paper, the Author wishes to stress the fact that his experience of deck machinery has been more concerned with the design and manufacture of such machinery, and that his knowledge of running and maintenance costs on shipboard, apart from that gained during a period at sea as an engineer, has been gathered largely from normal contacts with shipowners and builders. Any opinions expressed in this paper are his personal ones and not necessarily those of the firm with which he is connected. He trusts that any criticisms of or remarks about present-day practices will be taken by those concerned, who have wide experience in the provision and use of cargo-handling machinery, in the spirit in which they are intended, namely, to ventilate a subject which perhaps is sometimes given insufficient attention, and to promote a discussion which may be of some small interest and value to the shipbuilding and engineering industries in general.

The Development of Cargo-Handling Gear

Since early times, ships have sailed the seas with the principal object of carrying merchandise from one country where a surplus could be produced, to another country requiring that surplus. The loading and discharging of this merchandise in early times was a leisurely matter, and manual labour was the sole means employed. Even to-day, when labour is very cheap, manual labour is still used to the exclusion of mechanical power. An instance of this known to many is the coaling of ships at Port Said.

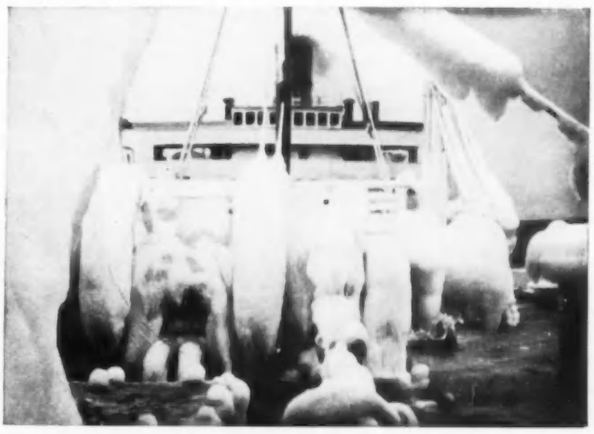
The introduction early in the last century, and rapid development of the steam engine as a means of propulsion for ships did not immediately bring about any improvement in the speed of handling cargo. It was actually well past the middle of that century before the first steam winches made their appearance on ships' decks. As a guidance towards the effect of this introduction, it is interesting to note that with four men at the handles of a hand winch, or " dolly," as it was called, a load of one ton could only be lifted at a speed of 10-12-ft. per minute, whereas even the earliest steam winches could lift this same load at about 150-ft. per minute. Steam power for cargo handling somewhat naturally held almost undisputed sway for the next fifty years, until the development of electric power on ships began. During this period, however, several ships were equipped with hydraulically-operated winches and cranes, which form of cargo-handling gear will be referred to later.

The conclusion of the last war saw the introduction and wide adoption of the internal-combustion engine for ship propulsion. The marine steam engineers, having progressed through the stages of the early oscillating-cylinder engines, and compound engines to the triple and quadruple-expansion engines taking steam from the tried and proved Scotch marine boiler, had settled down to the production of a reliable unit with a coal consumption of about 1.5 lb. per s.h.p. per hour. It is true the marine steam turbine had made its appearance, but its use had, on the score of capital cost and perhaps nervousness, been limited to the propulsion of warships and fast passenger liners. The figure of 1.5 lb. of coal per s.h.p. per hour for propulsion of a cargo boat was not good enough to compete with the economical internal-combustion engine, and the marine steam engineers had to set about improving the economy of their product, which they certainly have done, figures of about 1 lb. of coal being now quite common for ordinary tramp cargo steamers.

All this goes to show that tremendous thought and energy have been put into the problem of transporting cargoes from one port to another in a given time at a minimum cost. It is doubtful, however, whether the same thought and energy have been devoted to the economy of loading and discharging the cargoes. An average cargo boat is probably in port about a hundred days in the year, of which period considerably the greater part will be occupied working cargo. It is obvious, therefore, that the cost of working this cargo can have a considerable effect on the profit made by the ship.

The Choice of Power Units for Handling Cargo.

In drawing up the specification for cargo-handling gear of a ship for a given service, the shipowner or shipbuilder has to decide on the motive power to be employed, whether cranes, or derricks and winches will be more suitable, and the number and disposition of the powered units. The choice of motive power lies between steam, electric Diesel engine, hydraulic ram, and Diesel-hydraulic rotary units. The decision between derricks and cranes almost invariably results in derricks fitted, as giving a more flexible arrangement at cheaper cost. Cranes do, however, find favour for certain coastal trades, avoiding the necessity for stowing and rigging of derricks for short sea passages. The number and disposition of the powered units deeply depend largely on the size of the vessel (which governs the number of hatches to be served) and to a lesser extent on the type of cargo to be handled. The important decision to be made, therefore, is that of the motive power to be used.



Winter in the North Atlantic. An impression of the conditions under which deck machinery is sometimes in use.

Steam and electric drive for cargo winches each has its advantages and disadvantages, which will be dealt with shortly. Diesel drive, though economical in fuel consumption and comparatively cheap in first cost (provided some maker's standard mass-produced engine can be employed), lacks the flexibility of control so necessary for cargo handling. For safety and convenience a governed-speed constant-running engine must be used, driving the hoisting barrel through the necessary gearing and a friction clutch. Thus, creeping speeds necessary for breaking out cargo can only be obtained by slipping the clutch, a somewhat indefinite method, and light-hook speeds are limited to the full-load hoisting speed. Increased flexibility can be obtained by the introduction at a considerably increased cost, of a controllable hydraulic coupling between the engine and gearing. These characteristics have resulted in this type of drive being limited to lighters and certain small coasting vessels, which rely largely on shore gear for handling their cargo.

Hydraulic rams were introduced by certain owners for handling cargo before the end of last century with the sole intention of avoiding the noise which was and still is, to a lesser extent, invariably associated with the steam winch. Being very inefficient, the use of hydraulic rams on shipboard has almost completely ceased, while another serious disadvantage of this system was the liability of the water to freeze in cold climates. Rotary hydraulic-power units, in which the loss of the hydraulic medium is negligible, use oil as a medium and do not therefore suffer from this latter disadvantage. Their efficiency is not high, and though claims are made for 80 to 90 per cent. for certain systems, in practice 60 to 70 per cent. is nearer the mark. This means that whenever a hydraulic unit is utilised to transmit power from a prime mover—whether steam engine, Diesel engine, or electric motor—to a winch, about 50 per cent. more power must be put into the prime mover for a given power at the winch barrel than would be the case if the prime mover was directly connected to the winch. In addition, of course, the cost of the installation is very considerably increased.

It may be assumed with safety that the introduction of hydraulic transmission of power in deck machinery was due to the lack of reliable and satisfactory means then available of controlling electrical power, when the advantages of electrical power were first being utilised for working cargo. Now that

*Paper read on 14th February, 1941, before the North-East Coast Institution of Engineers and Shipbuilders, Newcastle-upon-Tyne. Reproduced by permission.

Ships' Cargo-Handling Gear—continued

comparatively reliable and satisfactory control systems are available for electric motors, there is very little to justify the cost of such an installation in any average cargo vessel. There is, however, one field where hydraulic power may still be of interest. Some small modern coasting vessels are each fitted with a Diesel-driven hydraulic pump in the engine room which can supply power to a pair of winches, or to the windlass and capstan, or to the steering gear, none of which groups is required to be in service simultaneously. Where space is limited both on deck and in the engine room and the engine room personnel is small, there are advantages to be claimed for this system. On the other hand, however, owners may hesitate to put all their important auxiliaries at the mercy of one Diesel engine. The conclusion reached almost universally when considering the question of motive power to be employed for working cargo is that direct-driven steam or electric winches are the most suitable, in that about 99 per cent. of ships afloat to-day are fitted with one or other of these types.

When Diesel-engined ships made their appearance, it became almost standard practice for these to be fitted with electric winches, while steamships continued to be fitted with steam winches. The introduction of electrical power for working cargo was largely for convenience, as no steam was available or required for other purposes, and the advantages of electricity were not then fully appreciated, while electrical power units on ships' decks were suffering from considerable teething troubles. The first essential feature of a cargo winch is reliability, and reliability under worse conditions of working than any other item of machinery on a ship. The reason for this is that the winch is handled by unskilled workmen who have no interest in the upkeep of the winch, and whose employers' payment varies proportionately with the speed at which the winches are driven. There is thus no incentive towards careful handling. Nevertheless, steam and electric winches can now stand up to the most arduous duties with very few stoppages, provided they are given the necessary routine maintenance and repair that all machinery requires.

A recently-built Diesel-propeller cargo liner. This vessel is fitted with 24 steam cargo winches.

The Economy of Cargo Handling

Assuming then that both types of winch are sufficiently reliable for their duties, there comes the question: " Which is the more economical? " To arrive at a decision there are three main points to consider, which are, the capital cost of the installation, the fuel cost to operate it, and the cost of maintaining it in good order. Electric winches cost considerably more than equivalent steam winches to buy—roughly, two-and-a-half times as much—without taking into consideration the costs of boilers and steam pipes and generating plants and wiring; but they cost considerably less to run. It is difficult to obtain accurate figures for the relative cost of fuel for working a similar cargo in or out of similar ships by steam and electric winches, but figures have been published making it almost ten to one in favour of electric winches. Probably about seven to one is a fair figure. One factor which greatly favours electric winches is that stand-by losses are reduced to zero, while in a steam outfit radiation and leakage losses are continuing whether the winches are working or not. It is not practical to shut steam off deck for stand-by periods of short duration.

Relative maintenance costs naturally depend on the types of winches being considered, the treatment they receive, and the attention given to them in routine overhauls, but it is generally accepted that, again, electric winches show a considerable saving over steam. From the cost of running and maintenance then, there is little to recommend the fitting of steam winches, but their lower capital cost gives them a great advantage, which has resulted in the majority of ships built in this country at any rate being equipped with steam winches. It is not economy, however, to allow initial cost to be the sole guide towards the settlement of which is the more economical type of winch for working cargo. There is no doubt that many ships at present in service fitted with steam winches could have earned considerably more profit for their owners if they had been fitted with electric winches. The converse, of course, is equally true, namely, that it is not economy to equip a ship with expensive electric winches, however economical they may be in fuel consumption when working, if they are to lie idle for long periods on the deck. It is however, a comparatively easy matter, knowing approximately the amount of cargo to be handled in a year, to calculate whether or not the extra expenditure on electric winches can be justified.

There is no need for this calculation to be affected in any way by the method of propulsion chosen for the ship, though apparently it often is. Consider the case of a shipowner who favours steam propulsion and is building a cargo tramp ship destined for a trade with comparatively short sea passages and frequent spells of cargo working. Surely the ideal equipment is an outfit of electrically driven winches taking power from one or more Diesel-driven generators, and such engine-room auxiliaries as are required for port use arranged for electric drive. Though the Author is without experience in this matter, he feels that where and when heating is required in port it could be provided electrically as cheaply as by steam. The result of such a policy would be that boilers could be shut down in port, and the extra capital charges due to such an installation quickly recovered by the resulting savings in port fuel costs. The provision of storage capacity for a small amount of Diesel oil, in addition to that for coal or boiler oil, is hardly an important disadvantage.

Reliability and Suitability of Steam and Electric Winches

Before leaving the general statement of the pros and cons for each type of winch the Author would like to refer briefly to the degree of reliability of each type mentioned earlier, and to couple with reliability some remarks about suitability. Steam winches suffer, somewhat naturally, considering the conditions under which they work, from a fairly high rate of wear and tear. Corrosion is going on in the cylinder castings all the time unless careful attention is paid to drainage at the conclusion of each period of cargo working. The wearing parts are, however, comparatively cheap and easy to obtain and, provided the makers are a reputable firm, easy to fit. Apart from wear and tear, of course, breakages often occur, sometimes due to failure to replace worn-out parts, occasionally perhaps due to faulty design or material in the winches, or to extraneous causes. One common cause of failure is water coming through the steam pipes. No winch running at speed can take solid water through the cylinders without suffering some damage. Unfortunately, water troubles are very difficult to overcome in deck steam pipe lines, supplying steam to intermittently working winches. All that can be done is to provide efficient insulation for the pipe lines, suitable arrangements for drainage, and perhaps the addition of a certain amount of superheat to the steam, and avoid pockets in steam pipe lines for the collection of water.

Electric winches have for some time been proved entirely reliable, but it would be folly to profess that such has always been the case. It is possible that failures of early electric winches are still influencing certain owners against their wider adoption to-day. Electric motors that had proved entirely satisfactory for land use when put to work on ships' decks proved totally inadequate to stand up to the arduous conditions imposed on them. Water found its way through joints previously considered watertight, insulation failed, armatures burst, contact failed to stand up to the treatment of unskilled labour, and a host of troubles arose which quickly brought about the necessary improvements in design and construction required for reliability. To ensure satisfactory service from electric winches, a certain amount of routine attention from skilled personnel is essential. Given this attention, electric winches probably cause considerably less stoppages of cargo working than steam winches. Such stoppages as occur, however, though perhaps serious in their consequences, are usually very simple in themselves, being due to such troubles as blown fuses in contactor operating circuits, burnt-out relay or contactor operating coils, burnt contacts, or mechanical defects in the control gear, all of which faults can be quickly located and repaired by skilled electricians or engineers. When major electrical breakdowns to occur, such as the burning out of an armature, they are generally due to faults in workmanship or material in the winches, as the protective features embodied in modern electric-winch control systems almost preclude such damage through careless handling.

Coming to the question of suitability, there is no doubt that the inherent characteristics of the steam engine are more suited for the duties of cargo handling than are those of the electric motor. The former is able to exert maximum torque at slow speeds for breaking out cargo, accelerates rapidly owing to low mass of rotating parts, and can sensitively control the lowering of loads. A normal series-resistance-controlled motor requires artificial load, generally provided by a foot brake to give slow speeds, and tends to give a jerky pull when accelerating as each step of resistance is cut out, and owing to the inertia of the armature, has a slower acceleration. Generally, no inherently controlled lowering of loads

Ships' Cargo-Handling Gear—continued

is provided by a series-resistance-controlled motor. This can be obtained by designing the motor field with a preponderance of shunt windings, which unfortunately reduces the speed range of the motor and hence the light speeds. An added disadvantage of a winch arranged for electrically controlled lowering, or dynamic braking as it is technically termed, is that it is unidirectional in operation, in that the winch must be running in a specified way for hoisting. While this causes no difficulty when using a fixed rope on the centre barrel, for whipping cargo or topping derricks from a warp end, care must be taken to put the ropes round the whip or warp end in the correct direction.

The most widely accepted type of winch, fitted with foot brake for lowering and light speed control, a magnetic brake for holding load automatically in the " off " position of the controller, and a centrifugal brake for limiting lowering speeds to a safe figure, does, however, give an entirely satisfactory means of handling cargo. Several types of control for winch motors have been developed which give the motors characteristics equivalent to that of a steam engine and of which mention will be made shortly; but these considerably increase the cost of an outfit of winches, and their use has been largely confined on shipboard to more vital machines such as the windlasses and capstans. Where silence while working is essential or desirable electric winches, speaking generally, are infinitely more suitable than steam winches, as anyone who has endeavoured to sleep underneath or anywhere near a normal steam cargo winch at work will fully appreciate. Electric winches are always ready for instant service, whereas steam winches require warming through, and the steam pipes thoroughly clearing of water before they can do their work. Opening up the steam valves for deck steam is often a very tedious operation, in cold climates particularly, any haste causing alarming noises and broken joints in the steam lines. Engineers who have had to lie in snow trying to thaw out frozen steam pipes with blow lamps in inaccessible places on deck, will doubtless fully appreciate the availability for instant service at any time of electric winches.

It is often stated that electric winches are faster working than steam winches. The size and power of winches are specified by shipbuilders or shipowners when enquiring for quotations, but both types of winch can be supplied to lift any load at any speed within reason. For optimum results, of course, the speed of lift of cargo winches should bear some direct relation to the height of lift required. The time required for preparing a load for lifting is practically constant whatever the size of the vessel, and the speed of the winch should be such that a load can be discharged or shipped and the hook returned for another load in time to meet the completion of its preparation for lifting. Accordingly, small coasters are fitted with comparatively slow winches capable of lifting full load at about 50 f.p.m., and passenger cargo liners with high trunked hatches with winches giving speeds of 150 f.p.m. or more on full load. When considering the power or speed of haul per winch to be installed, however, the initial cost of the winch, which varies with the power, is not always the only factor to consider. In the case of steam winches on a steam-propelled vessel, it is almost certain that sufficient steam capacity will be available on the vessel to meet any reasonable requirement. In the case of steam or electric winches on a Diesel-engine-driven vessel, however, the size of the boiler or of the generating plants respectively will be generally determined by the power of the winches, and the cost of the said boiler and generating plants must also be taken into consideration. In either case, of course, the fuel cost per hour to operate the winches will vary almost directly with the winch power installed.

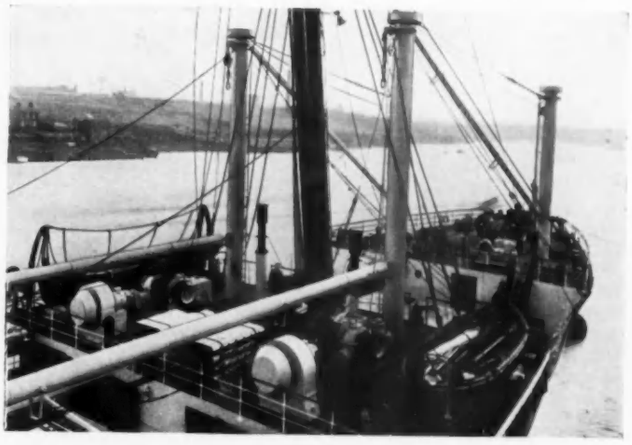
Types of Steam and Electric Winches

The foregoing remarks have covered briefly the relative advantages and disadvantages of steam and electric drive for cargo winches, the comparisons being made on general lines between the types most commonly used on shipboard. There are and have been, however, many variations of both steam and electric winches available on the market, and to obtain a true picture of the efforts that have been and are being made to provide improved cargo-handling machinery it is necessary to make mention of these various types of steam and electric winches.

Steam Winches

The normal type of steam cargo winch in common use to-day differs but slightly in all its details from the first steam winches produced. All working parts are exposed to the atmosphere, and lubrication is provided when the donkeyman thinks fit. It must not be assumed, however, that the preservation of the normal steam cargo winch in its original form is due to the inability of winch makers to design and produce a more refined article. It is the demand for an article that creates its supply. Though comparatively rarely called for, there are refinements available for owners who are prepared to pay the extra price unfortunately but of necessity entailed, designed with the object of giving longer life to wearing parts and producing a quieter working winch. Lubrication, an important item often not given sufficient attention, is normally by oil in preference to grease. Such cover as is provided for oil cups and oil holes must be easily and instantaneously removable for the application of oil, as bearings must be lubricated without interfering with the running of the winches. It is not possible, therefore, to make oil cups and oil holes watertight, and such oil as is supplied to the bearings in generally accompanied by water and other foreign matter which does not make the already arduous duty of a winch any easier. If watertight covers were provided it is doubtful if lubrication would be supplied at all until its absence was obvious. To overcome this difficulty grease lubrication can be and has been supplied, but not on a large scale. It is definitely easier and safer to pour oil into a cup or hole than to screw down a grease cup or attach a gun to a grease nipple, especially on parts that are liable to start in motion without warning. As has been mentioned earlier, winch drivers have no interest in the upkeep of winches.

Much of the noise of a standard steam winch emanates from the spur gearing, which is normally of the moulded tooth type. A considerably quieter and more efficient winch is obtained by the fitting of machine-cut gear running in oil-tight gear cases, and the life of the gearing is prolonged almost indefinitely, but again, of course, extra initial cost is entailed. The Carron type of worm-geared steam winch is quiet and clean, all engine parts and gearing being totally enclosed and running in oil. Unlike the normal spur-geared winch with single and double gear, only one speed



A recently-built turbine steamer. This vessel is fitted with 12 electric cargo winches.

is obtainable on this winch and its steam consumption is high, engine control being by a differential valve which permits of no cut-off being provided. Recently a certain superintendent engineer required a number of steam-driven winches for placing on the deck of a passenger liner. They were required to be silent in operation, and to have a smooth and clean exterior, to ensure that there would not be complaints from passengers about lack of sleep and contamination of clothing. The necessary winches were duly designed and supplied and are understood to have given entire satisfaction. The engine and gearing, which was of the two-speed spur type, were totally enclosed and were entirely self-lubricating, an engine-driven pump supplying oil to all parts, including every working part of the link motion gear.

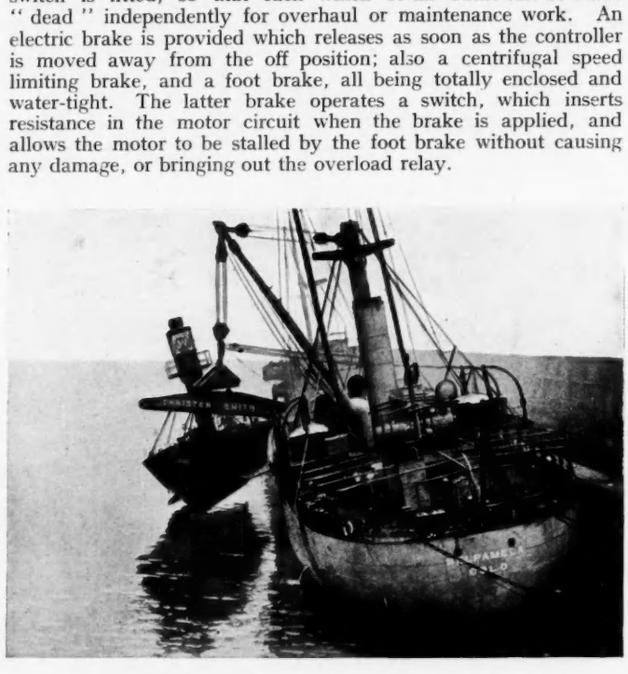
That types of winches exist possessing greater refinement than the standard types in general use is mentioned in an attempt to refute the statement often made that winch manufacture has not progressed in any way during the last fifty years. However, to justify the policy of owners who prefer to utilise the standard article, it must be understood that such refined winches as those last mentioned are comparatively expensive, and the relative cost of such a winch and an equivalent electric winch is considerably nearer unity than with the standard article. Where passengers' comfort and convenience are to be studied, the cost of such winches can be justified, where the periods of working are not sufficient to justify the still further cost of electric winches and their ancillary equipment.

Electric Winches

Electric winches also appear in a variety of forms, and several technical papers have been read before this and other institutions on the subject of the motors and control systems in use for electric winches and other electric auxiliaries on shipboard. It is not proposed, therefore, in this paper to give any detailed description of the many and varied types of electric control for winches. The simplest and cheapest type of electric winch available on the market is undoubtedly the two-speed spur-geared drum-controlled type, which is largely fitted by Continental shipowners, but has not been adopted to any great extent by shipowners in this country. Though cheap in first cost, drum control is not generally considered suitable for the heavy duties of cargo handling, in the hands of unskilled labour. Some winches of this type do not possess the advantage of silent working generally attributed to electric winches, and are in fact, noisier than some steam winches.

Ships' Cargo-Handling Gear—continued

The type of electric winch in general use by shipowners in this country is the worm-geared contractor-controlled type, and it was on this type of winch and a standard steam winch that the cost ratio between steam and electric winches given earlier in the paper was based. A totally enclosed watertight motor mounted on the winch bedplate drives the barrel shaft through worm gearing running in an oil-tight gear case. If whipping drums are required in addition to the barrel and warp ends, these can be provided by driving a whipping shaft through a step of spur gear from the barrel shaft. The motor is controlled by a small master controller which operates the contactors. Overload and no-volt protection is provided, also relays to prevent too rapid reversal of the motor, while the contactors are interlocked for the correct sequence of operation and controlled either by current lock-outs or fixed timing devices for the correct speed of operation. To enable the full horse-power of the motor to be used on light loads, a load discriminator is fitted, which takes the place of a mechanical change speed gear, but its action is automatic. An isolating switch is fitted, so that each winch of an outfit can be made " dead " independently for overhaul or maintenance work. An electric brake is provided which releases as soon as the controller is moved away from the off position; also a centrifugal speed limiting brake, and a foot brake, all being totally enclosed and water-tight. The latter brake operates a switch, which inserts resistance in the motor circuit when the brake is applied, and allows the motor to be stalled by the foot brake without causing any damage, or bringing out the overload relay.



A difficult piece of cargo. One of the Belships fleet is here shown loading with her own gear a lightship weighing about 100 tons.

The position of mounting for the controller and control gear is optional, but the general rule is for the controller to be mounted on top of the motor, and the control gear and resistance either in compartments formed in the winch bedplate, or in a water-tight case mounted on the bedplate, in both the cases, the necessary ventilation being provided. Alternatively, the control gear and resistance can be mounted in deckhouses, so that the necessary maintenance work can be carried out on the equipment in any weather. It is surprising that this arrangement is not more widely adopted, as it is almost certain that the slight loss of deck space caused by the provision of deckhouses would be more than compensated for by the greatly increased facilities for the proper care of and attention to the control gear. Another advantage not often claimed for winches with the control gear mounted separately, but present nevertheless, is that there is no obstruction behind the winch barrel, and whipping can conveniently be done from the barrel in addition to the warp ends and whips, if fitted. Electrical faults due to ingress of water through ventilators accidentally left open are absent when the control gear is mounted in a deckhouse. Master controllers may also be placed remote from the winch, but for satisfactory control of contactor-geared winches, the foot brake must also be operated from the position chosen for the controller. Occasionally, one finds winch controllers placed in front of their respective winches so that the operator can overlook the hatch. Winches have also been supplied with portable double controllers for each pair of winches, connected to the winches by flexible multi-core cables, so that one operator can work cargo, looking down the hatch, or over the ship's side as required.

The foregoing remarks on the position of the controllers and control gear, though included in the description of contactor geared winches, are in general applicable to all types of electric winch. Of the special types of electric cargo winches on the market, probably the best known is the " Wilson " winch. Though considerably more expensive than an equivalent normal contactor-geared winch, its several attractive features have led to its standardisation on the vessels of more than one important company. Its main advantages are short fore-and-aft dimensions enabling large hatches to be provided in a given deck space, and almost complete silence in operation (so much so that stevedores below have been heard to complain bitterly that they do not know the hook is coming until it hits them!). The winch consists of a large-diameter slow-speed motor driving a co-axial barrel through epicyclic gearing, the planet pinions of the epicyclic gear being mounted on a spring-controlled torque arm which operates a variable load discriminator. The controller has three steps hoist and lower, the first step hoist being an armature diverter step to give a slow speed for tightening slings, followed by two series resistance steps, while the lowering side has three steps of potentiometer braking. Loads are held in the off position by the motor being short-circuited across itself with the shunt field applied.

Other types of electric winch employ variations of the well-known Ward Leonard principle for control, such as " booster," " reducer " and " convertor " control, all of which have formed the subject of previous papers before technical institutions. Once teething troubles were overcome, the results in service of winches fitted with these types of control have supported the claims made for them of smoother operation, more delicate control, and reduced maintenance costs. Their initial cost is high, however, and as perfectly satisfactory results can be obtained from modern contactor-controlled winches, it is doubtful if their adoption can be justified on an economic basis. When considering the cost of electric winches particularly, the cost should be that of the type, not the quality. A cheap type of winch of expensive quality is, of course, infinitely preferable to an expensive type of winch of cheap quality. An early attempt to overcome the difficulty of controlling electric motors satisfactorily was the Macfarlane winch, in which a constantly running motor drove a number of barrels, generally four, through epicyclic gears engaged at will by external brake bands. The difficulty of maintaining the various brake bands in proper adjustment made this winch somewhat unreliable, and very few (if any) are in service to-day.

Derricks

The subject of cargo-handling gear is not complete without some reference to derrick arrangements, and heavy lift derricks. Derricks were originally of timber construction, but are now almost universally of steel, tubular in form, having less weight for a given strength. The number and disposition of derricks fitted, as mentioned earlier, depends entirely on the number and size of hatches to be served. A normal tramp cargo steamer has two derricks per hatch, mounted one on either side of the ship's centre-line, the derrick heels being on a table running athwartship some 6-ft. above deck level, and the topping leads being taken from either to cross trees on the masts, or from sampson posts to the derrick heads. For cargo working, one derrick is trained over the side and the other over the centre of the hatch, the load being lifted on one derrick, transferred in mid-air, and lowered by the other derrick, with each derrick guyed in position.

Small coasting vessels are generally fitted with slewing derricks, each mounted on the centre-line of the ship, which work cargo in or out of the ship by slewing inboard or outboard, controlled by man power or by small slewing winches. For slewing derricks handling heavy or difficult loads, where it is desirable to plumb any part of a hatch with the hook the topping lead is led to another winch barrel so that the angle of the derrick can be adjusted at will. The controls of this winch and those of the hoisting and slewing winches, are so grouped that one operator can handle all motions. For normal derricks, the topping lead is shackled to the deck, and adjustments made to the derrick angle when required by taking a few turns round a winch warp end and hoisting or lowering. In all cases the hoisting rope lead is taken from the winch barrel back to the derrick heel block, and through a block at the derrick head to the hook. The distance between the winch barrel and the derrick heel block is of the order of 6 to 8-ft. This short distance, therefore, does not allow the wire to spool correctly on the barrel, and it tends to pile up on the centre of the barrel. To improve the working life of a wire, surely a better arrangement would be to take the hoisting lead some distance up the mast or sampson post and through an eye formed in the derrick head. With this arrangement of wire lead it would be possible to mount winches on the derrick tables, or deckhouses, and allow for longer hatches to be provided in the same deck space. Careful attention should be paid to rope guards, to prevent slack wire coming off the barrel of a winch and becoming wedged between the barrel boss and side frame.

Heavy-lift derricks form part of the cargo-handling equipment of many units, designed for lifts of up to 150 tons in some cases. A well-known fleet of ships, owned by Christen Smith, Oslo, was designed entirely for heavy-lift transportations. Heavy-lift derricks are placed of necessity on the centre-line of a ship, the heel being fitted to the deck, which must be suitably stiffened locally to withstand the heavy loads imposed thereon, and the mast to which the derricking and hoisting leads are carried must be securely guyed. Heavy lifts are transported inboard or outboard by slewing the derrick by power through multi-purchase blocks.

(Concluded on page 156)

Maritime Services Board of New South Wales

Excerpts from Fifth Report for the Year ended 30th June, 1940

PORT OF SYDNEY.

Financial.—The accounts for the year ended 30th June, 1940, show a net surplus of £301,198 7s. 0d., which is an improvement of £62,471 18s. 3d. as compared with the previous year, when the surplus was £238,726 8s. 9d.

Income.—The net income earned during the year, namely, £1,203 226 19s. 1d., exceeded the figures of the previous record year, that ended 30th June, 1938, by £16,947, 15s. 6d. The improvement as compared with the year ended 30th June, 1939, was £47,599 15s. 9d.

Oversea Trade.—The principal source of the Board's revenue is wharfage rates on overseas imports, the revenue from which during the year amounted to £342, 467 4s. 4d., as compared with £341,590 4s. 2d. for the preceding year, an increase of £877 0s. 2d.

The revenue from wharfage rates on goods shipped overseas increased from £70,759 2s. 7d. to £80,070 6s. 10d.

Inter-State Trade.—The income from wharfage rates on imports from Inter-state ports was £178,213 9s. 7d. as compared with £184,110 9s. 8d. for the preceding year. The return from wharfage rates on exports to other States increased from £55,020 2s. 10d. to £62,020 8s. 4d.

Intra-State Trade.—The income from wharfage rates on both Intra-State imports and exports declined slightly during the year. Inward wharfage rates amounted to £88,357 2s. 1d., as compared with £89,972 7s. 8d. for the previous year, and outward wharfage rates returned £21,979 16s. 8d., as compared with £22,181 11s. 4d.

Revenue Expenditure.—The expenditure chargeable against income amounted to £902,028 12s. 1d., as compared with £916,900 14s. 7d. for the year 1939.

Capital Expenditure.—The expenditure on "capital" work during the year was £65,449 11s. 10d.

WORKS AND IMPROVEMENTS.

Circular Quay.—The carrying out of a section of the scheme for the treatment of the Circular Quay area in conjunction with the completing of the City Railway, has been allotted to the Board, which section includes, amongst other items, the remodelling of the ferry jetties along the Quay front.

The new Manly ferry jetty (No. 3) has been completed and the Port Jackson and Manly S.S. Co., Ltd., is now in occupation of the premises. The building is of steel and timber framing, covered externally with rusticated weatherboards of varying widths, whilst the roof, which is practically flat, is covered with copper. Office accommodation has been provided for the ferry company and a shop has been built in, facing the promenade.

The new No. 4 ferry jetty has also been completed and the Mosman and Cremorne services of the Sydney Ferries, Ltd., are now operating from this jetty. In structure, the building on the wharf proper and the covering on the pontoon are similar to those at No. 3 ferry jetty.

A commencement has been made with the remodelling of No. 2 ferry jetty, and the work was well advanced by the end of the year.

Nos. 4-5 Berths, Walsh Bay.—The remodelling of Nos. 4 and 5 berths, Walsh Bay, was completed during the year. The upper floor of the shed is now on the one level and the height of the wharf deck at No. 4 berth has been raised to that of No. 5 berth, also the lower shed has been widened by twenty feet and a trucking platform provided on the western side at the upper floor level of the shed.

The remodelling, together with the installation of up-to-date lifting appliances, will permit of more effective use being made of the upper and lower floors of the premises and will generally facilitate the handling of cargo.

The wooden bridge spanning Hickson Road and leading to the upper floor of the shed was demolished and replaced with a new and wider bridge, constructed in steel with a concrete deck.

New Passenger Jetty at Manly.—The reconstruction of the passenger jetty at Manly was commenced early in the year and the work is being carried out in two sections in order that inconvenience to the travelling public may be reduced to a minimum. The eastern side of the new jetty has been practically completed and a commencement has been made with the construction of the western side.

The design of the shed being erected on the jetty provides for a building comprising a main concourse (130-ft. by 100-ft.), from which extends a jetty shed, 325-ft. by 60-ft. On each side of the concourse there will be shops and lavatory accommodation, whilst the frontage to the Corso will be semi-circular in shape and covered for its full width with a deep awning. The shed extending beyond the concourse will be enclosed on both sides, with the exception of a section (150-ft. by 60-ft.) at the outer end, which will be in the form of an open shed.

The steelwork of the eastern side of the shed had been erected by the end of the year and the roofing of the shed well advanced.

The reconstruction of the existing jetty involved placing the eastern and the western side out of commission alternately, and it was therefore necessary during the transition stage to provide supplementary accommodation for the ferry steamers in order to obviate inconvenience to the travelling public, particularly during the peak periods of traffic. The adjoining cargo was accordingly strengthened, and is being used in conjunction with the existing jetty as circumstances demand.

Nos. 12-14 Berths, Pyrmont.—The Board's programme of works in connection with the remodelling of the premises for the handling of refrigerated and other rail-borne goods shipped from the Port, also for general cargo and passenger purposes, was proceeded with during the year.

The remodelling scheme provides for the reconstruction of roads and approaches to the berths, the erection of new sheds and the widening, also redecking in concrete, of the wharf apron on the western side.

At the end of the year considerable excavation work had been carried out in connection with the construction of a permanent roadway, 60-ft. wide, at the back of the premises, and two lines of rail tracks had been laid.

The foundation and the concrete floor for a new shed at No. 13 berth have been practically completed. This shed will eventually be a two-storey structure (480-ft. by 100-ft.) specially designed for the handling of passenger traffic on the upper floor.

The laying of the foundation for a new shed at No. 12 berth has been commenced and to date some 230 foundation piles have been placed in position, 500 lineal feet of concrete wall has been erected, and a large portion of the floor area has been levelled off.

The wharf apron at No. 14 berth has been completed for its full length, the area covered by the three sets of railway tracks has been concreted, and the gantry rail reset in its new position.

No. 3 Shed, Glebe Island.—The new shed, the erection of which was commenced during the preceding financial year, has now been completed. The shed is a steel-framed structure with galvanised iron ends and sides and a roof of corrugated fibrolite. The building is irregular in shape, the dimensions being 400-ft. long with a maximum width of 120-ft., and a mean width of about 100-ft.; the floor space covered by the shed is 40,680 sq. ft.

Nos. 6-9 Berths, Glebe Island.—With a view to providing improved roadway approach to Nos. 6-9 berths, Glebe Island, a commencement was made, during the preceding financial year, with the construction of a permanent roadway at the rear of the premises. The new roadway, which is 1,880-ft. long and 20-ft. wide, has now been completed.

Treatment of Piles against Attacks by Marine Organisms.—In the year 1935 the Board initiated the systematic treatment of piles with creosote, contained in a floating collar round the piles, with a view to preventing attacks by marine organisms. The majority of the piles in the main wharfage areas of the Port have already received two applications of creosote, and a commencement was made with the third treatment, during the course of which it was found that the piles did not show uniform resistant results to re-infestation.

An unexpected and severe attack by Martesia (a bi-valve) was experienced in a wharf structure at Bantry Bay, Middle Harbour, which was combated by casing the piles with a tar-cement compound. This organism, which works with extreme rapidity, is known to have been very destructive at Panama, but such has not been the experience at the Port of Sydney until the attack above referred to.

The treatment of wharf timbers with creosote, by means of a portable spraying plant, for the eradication and prevention of white ant infestation and fungus has been continued during the year with satisfactory results.

So far as fungus attack is concerned, inspection this year of treated portions of decking laid in 1935 revealed that the timbers were quite sound. Difficulty is still being experienced in sterilising the timber at the junction between the decking and girders, but it is anticipated that a satisfactory solution will shortly be found.

PORT OF NEWCASTLE.

Condition of Wharves and Properties.—Work is proceeding in connection with the low-level extension of Lee Wharf, and it is anticipated that this will be completed at an early date.

Repairs have been effected to wharves and properties generally to the extent of the funds available, but it has been necessary to defer certain repairs and renewals for the present.

Future Development.—Proposals for future development of navigation and rail facilities at Newcastle are still receiving consideration by officers of the Board and the departments concerned, and it is hoped that a final scheme will be adopted in the near future.

Included in works which it is proposed to undertake as soon as funds are available are the construction of a shed on No. 2 Silo Wharf, the erection of a wharf for intra-state vessels in the vicinity of Merewether Street, and the provision of new accommodation for ferry traffic at Market Wharf.

Karachi Port Trust

Excerpts from Administration Report for the Year ending 31st March, 1940

Finance.—In round figures:—

The ordinary Revenue Receipts for the year were Rs. 72,78,000 as against Rs. 78,21,000 in the previous year, a decrease of 7%.

The Revenue Account expenditure on ordinary items was Rs. 70,23,000 as against Rs. 69,99,000 in the previous year.

The final result was a surplus of Rs. 2,55,000 on the year's working.

A sum of Rs. 44,000 was transferred from the Revenue Account for Major Capital Works.

Cargo.—The total volume of imports and exports was 2,134,000 tons, or a decrease of 5.4% over the previous year's figure of 2,256,000 tons.

Imports were 856,000 tons, or a decrease of .5% over the previous year's figure of 861,000 tons; exports were 1,278,000 tons, or a decrease of 8.4% over the previous year's figure of 1,396,000 tons.

Shipping.—Foreign-going vessels entering the Port and using the Ship Wharves were less than those of the previous year by 69 in number, or 9.8%, and the net register tonnage was less by 256,482 or 11.4%.

Coasting vessels entering the Port, whose cargo is mainly handled by lighters over the Native Jetty, were less by 54 in number, or 20.3% and the net register tonnage was less by 88,051 or 19.7%.

Engineering Works.—The cost of engineering works carried out during the year compares with the previous year thus:—1939-40, Rs. 19,67,999; 1938-39, Rs. 24.73,569.

The following important works were carried out during the year:—

The special repairs to Berths Nos. 4 and 10 East Wharves, referred to in the last year's report, were completed at a total cost of Rs. 66,600.

In order to prevent further erosion at the end of the West Wharf reclamation, the Groyne at the South end was extended at a cost of Rs. 42,884.

This will also provide additional accommodation for flying boats and improve navigational conditions in the main channel.

A block of 42 workmen's quarters complete with latrines was constructed at Manora at a cost of Rs. 65,900, under the five years' scheme referred to at the end of the last year's report.

Dredging the Harbour.—The total expenditure on dredging operations during the year amounted to Rs. 4,61,144 against Rs. 4,48,219 during the previous year.

As against 1,627,425 tons dredged in the previous year, 2,216,440 tons were dredged during the year. This is the largest quantity dredged in one year since 1932.

Ships' Cargo-Handling Gear

(Concluded from page 154)

As a general rule, the winches used for heavy derrick work are quite normal winches, apart from being fitted with long barrels to accommodate large quantities of wire, and the heavy pulls for lifting the loads and topping the derrick are obtained through the necessary purchase blocks.

The handling of bulk cargo, such as grain and oil, is a subject which it is not intended to broach in this paper.

Conclusion.

In conclusion, the Author would like to express his appreciation of the opportunity afforded by the Institution for the reading of this paper, on a subject which is often looked on as a necessary evil, but which forms, in fact, an important part of the principal products of the North East Coast.

United Kingdom and London Trade Returns.

According to the Annual Statement of Trade for the year 1939, recently issued, the value of the imports and exports of merchandise of the United Kingdom and the Port of London respectively, are as follows, viz.:—

	United Kingdom £	London £	London's % of U.K. 1939 %
Imports	885,512,502	344,440,405	38.9
Exports, United Kingdom ...	439,535,710	113,207,280	25.8
Exports, imported Merchandise. ...	46,033,592	25,633,518	55.7
Total ...	1,371,081,804	483,281,203	35.2

New Russian Inland Waterway

Canalisation of the River Yauza

The Yauza River, a small and shallow tributary of the Moscow River is to be converted into a navigable waterway. Extensive construction work has been carried out along its course, and a canal 2.6 miles long has been built to link up the river with the Moscow-Volga Canal. It is estimated that some 500,000 tons of cargo will be transported along the canalised Yauza annually. The river has been widened to 82-ft. Its depth will be 8¼-ft. Tugs, launches and barges up to 74-ft. long will be able to pass through the lock on the upper reaches of the river.

The general scheme for the reconstruction of Moscow adopted in 1935 provides for the complete reconstruction of the Yauza River and its environs. In addition to linking up the river with the Moscow-Volga Canal, the Yauza was to be deepened and made navigable, and its banks lined with concrete; eight barges were to be built and 17½ miles of roadway either widened or newly made. Reconstruction work was commenced in 1938.

Embankments have already been built over a length of 6¼ miles. Three of the new bridges are open to traffic; three others are under construction, and the building of the last two will shortly be commenced. According to Professor A. E. Stramentov, head of the Civil Engineering Department of the Moscow Soviet, 5,120,000 cu. ft. of concrete has been laid along the banks of the Yauza during the past two years, and 12½ miles of roadway and squares have been asphalted. The new thoroughfares along the Yauza will be transformed in the near future into fine avenues. New squares have been constructed and a large park laid out where waste land and marshes existed but a short time ago.

Port Movements of Deep-Sea Shipping

Regional Representatives Appointed by Ministry of Shipping

The following appointments to the post of Regional Representative—in certain districts—for the Ministry of Shipping have been made by the Ministry.

For the Bristol Channel ports: Sir W. Reardon-Smith, who will act in conjunction with Messrs. Hill, Hinde and Rees as local representatives at Bristol, Cardiff and Swansea, respectively.

For the ports from Holyhead to Silloth inclusive: Mr. J. R. Hobhouse, with Mr. Torrey and Mr. Stokes as local representatives for Liverpool and Manchester, respectively, and Mr. Taylor a sdeputy-representative for Barrow-in-Furness.

For ports in the Clyde area: Mr. J. C. Denholm at Glasgow in collaboration with Mr. Needham as local representative at Greenock.

The above-named Regional Representatives will work in close co-operation with the local representatives and with all the authorities whose functions relate to the turn-round of ships. They will also be available for consultation by ship owners and agents who desire their advice or have suggestions to put forward.

Publication Received

War-Time Building Bulletin No. 13. "Fire Protection of Structural Steelwork."

It has been estimated that for every ton of steelwork irreparably damaged by high explosive bombs at least 10 tons have been destroyed by fire. The fire protection of structural steelwork is, therefore, of first class importance. The latest War-Time Building Bulletin issued by the Building Research Station of the Department of Scientific and Industrial Research—Bulletin No. 13, "The Fire Protection of Structural Steelwork," H.M. Stationery Office, price 1s., therefore commands attention because it deals with this important subject. Structural precautions against fire and the organisation of fire fighting arrangements should go together. The more effective the structural precautions, the less will be the effect of any fire started and the easier it will be to deal with.

The Bulletin is divided into two parts. In the first, simple rules are given for assessing the degree of protection appropriate to different occupancies, having regard, however, to the accessibility of fire fighting services. The second part then shows how the different degrees of protection may be obtained. A variety of treatments are described, and in most cases illustrated, and tables are given relating the thickness of treatment to the degree of protection provided. There is added a list, furnished by the Building Centre, of firms known to supply products of the type described.

The suggestions in the Bulletin deserve study for application both to new and existing structures, including of course, dock sheds and warehouses, for even where, in existing structures, the beams and trusses would be overloaded by application of heavy fire protection material, treatment of the stanchions alone will limit the damage.